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# RESPIRATORY DISEASE RESEARCH

JOHN H. DINGLE, *M. D.*

IT IS INDEED an honor and a privilege to present the "James Stevens Simmons Memorial Lecture," not only because of my deep personal respect and affection for General Simmons, but also because of my interest in the field of preventive medicine to which his philosophy and leadership contributed so much during and since World War II. All of us who worked with him felt the impact of his philosophy. General Simmons believed in the importance of preventive medicine in protecting and advancing the health, welfare, and security of our nation. He believed firmly that research is the basis of advancement in preventive medicine as in the other medical sciences: application of knowledge is essential, but new knowledge must also be sought. And he repeatedly emphasized that the military forces hold many unique advantages for intensive and long-term investigation.

General Simmons implemented his philosophy in a variety of ways. One of his concepts led to the establishment of the Army Epidemiological Board and its several Commissions—the forerunner of the present Armed Forces Epidemiological Board. The work of these Commissions offers many examples of the contributions that can be made through research in the military forces. I have chosen to discuss the problem of acute respiratory infections in recruits for several reasons: it is a major problem of recruit training; the problem was defined more sharply than formerly by studies of the Commission on Acute Respiratory Diseases during the War; work on the problem since the War has led to the isolation of at least one of the etiologic agents involved; and, finally, an effective method for prevention and control may soon be available.

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From the School of Medicine, Western Reserve University, Cleveland, Ohio.

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Certain of the data included in this paper were derived from studies conducted under the auspices of the Commission on Acute Respiratory Diseases, Armed Forces Epidemiological Board.

In December 1941, a group of investigators,* most of whom were members or associates of the Commission on Influenza and Pneumonia, was sent to Camp Claiborne, La., to study an outbreak of primary atypical pneumonia then occurring at that post. At the termination of this field study in the spring of 1942, General Simmons proposed the continuing study of respiratory diseases in the Army. As a result, the Commission on Acute Respiratory Diseases** was organized and the Respiratory Diseases Commission Laboratory was established at Fort Bragg, N. C., in October 1942. The assignment was broad: to study the problems of respiratory diseases in a military post. The post selected was large, varying between 24,000 and 65,000 men, of whom a large proportion were recruits.

The general approach to the problem was threefold. It was hoped that clinical observations could be made the basis of the work, that epidemiologic studies would provide data concerning incidence and mode of spread, and that laboratory observations would lead to confirmation of diagnoses and studies on etiology. It was further anticipated that correlations of these data would aid in delineating possible new entities.

Six organizations on the post were selected for the initial studies. The usual clinical and laboratory observations were made on patients with respiratory diseases admitted to the hospital from these organizations. Epidemiologic analyses were based on organizational strength figures. Bacteriologic and serologic methods were employed for confirming the diagnosis of known or presumed disease entities. These early studies were of little significance in terms of the data obtained, but they were of considerable significance in other respects. They showed, for example, that relatively few men were admitted to the hospital for respiratory disease from the six organizations selected for study. These organizations were composed mainly of men who had completed basic training and had been in the service for at least several months. The great majority of hospital admissions for respiratory disease came from the Replacement Training Center, composed principally of recruits.

The studies further emphasized the importance of methods. It was apparent that clinical observations had to be made as objectively as possible and that detailed daily records were necessary to describe accurately the course and progression of the illnesses. The epidemiologic studies required sources

*The members of this group were Drs. T. J. Abernethy, G. F. Badger, G. J. Buddingh, J. H. Dingle, A. E. Feller, A. D. Langmuir, J. M. Ruegsegger, and W. B. Wood, Jr.

**Members and professional associates of the Commission were: J. H. Dingle, Director, T. J. Abernethy, G. F. Badger, J. W. Beard, N. L. Cressy, A. E. Feller, I. Gordon, A. D. Langmuir, C. H. Rammelkamp, Jr., E. Strauss, and H. Tatlock.

of data better than uncontrolled admissions to the hospital and organizational strength figures. A military population offers unique advantages in this regard. The size of the population group, or the denominator, can be reliably determined on a daily basis from organizational and furlough rosters and the morning report, because there are only three places for a soldier to be: present for duty, in the hospital, or absent from the post for one of several reasons. Similarly, the number of cases, or the numerator, can be determined accurately. If criteria are established for admission to the hospital, the admission rate provides a reliable index of the occurrence of the more severe illnesses. The rates of occurrence of the milder illnesses can be determined from dispensary visits and from interviews or surveys of selected units in the field. It was likewise apparent that the value of laboratory data was directly related to the accuracy and reliability of methods. Subsequent studies of the Commission were therefore organized and carried out with these factors in mind. I should like now to summarize certain of the studies pertaining to the undifferentiated respiratory illnesses.

The major problem proved to be the large group of respiratory illnesses that could not be diagnosed specifically by clinical and laboratory methods. This group was termed the "undifferentiated common respiratory diseases." It was defined and delineated by the exclusion of known causes of respiratory illness, namely, bacterial infections, fungus infections, and known virus infections such as influenza. Variations were considerable in the characteristics of the remaining cases, from those resembling the common cold to grippelike illnesses and atypical pneumonia. Leads were therefore sought for the segregation of possible entities from within this large group.

Epidemiologic analyses provided a major clue.[1] Figure 1 shows the hospital admissions for respiratory disease in recruits of the Replacement Training Center and from other organizations composed mainly of seasoned men. It is apparent that most of the patients came from the Replacement Training Center. For the most part, these men were sent to the Center for basic training directly from induction centers, so that they were undergoing their first military experience. The training period lasted about 17 weeks. A double peak in the admission rates of recruits occurred during the winter of 1942-1943, due to a complete turnover in the population of the Training Center. The attack rate for seasoned men was somewhat elevated during this same winter, whereas, with one exception, it remained consistently low thereafter. Analysis of the population data showed that these illnesses occurred almost entirely in recruits who had been assigned on induction to established organizations without a prior period of basic training, so that this peak actually represents recruits

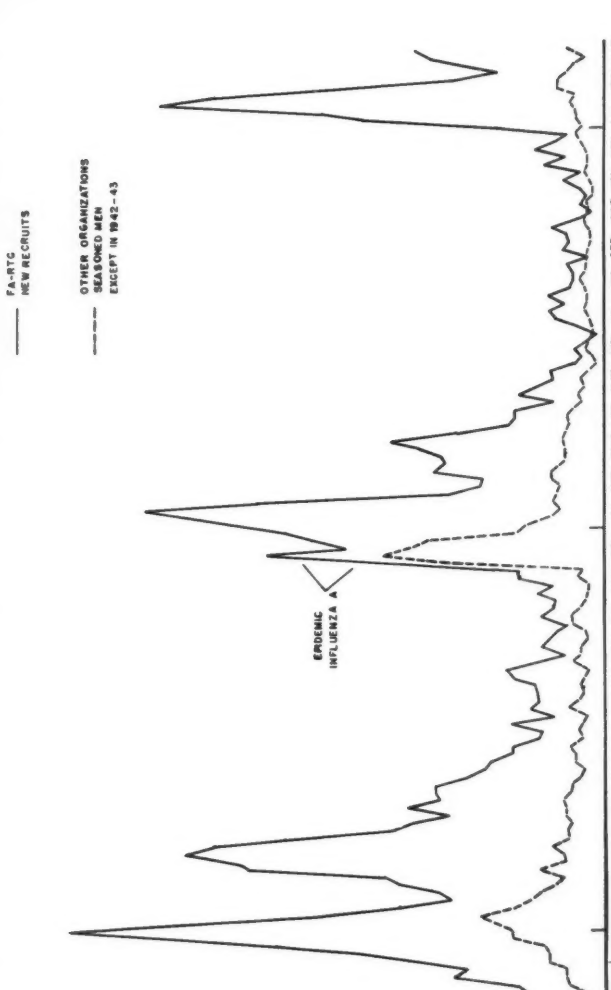


*Figure 1.* Admission rates for respiratory disease from the Field Artillery Replacement Training Center (FA-RTC) and other organizations at Fort Bragg, N. C., from 31 October 1942 to 30 March 1945.*

*Figures 1 through 5 are taken from: Acute respiratory disease among new recruits. *Am. J. Pub. Health* 36: 439-450, May 1946,[1] with the kind permission of the Commission on Acute Respiratory Diseases and the publisher.

undergoing their first military experience. In November 1943, the rates among both recruits and seasoned men rose abruptly. This increase represented an epidemic of influenza A. As the epidemic subsided, the rate in seasoned men declined sharply to low levels, whereas the rate for recruits remained high, fluctuating with population turnover. Thus influenza behaved differently from the other respiratory diseases, and this difference provides a means of recognizing the occurrence of true influenza in a military population. In the third year, the attack rate for recruits again rose, whereas that for seasoned men remained low. These patterns of epidemiologic behavior suggested that respiratory disease in recruits differed from that in seasoned men and might constitute a distinct etiologic entity. It also seemed possible that experience with this entity might be a major factor in the "seasoning" process.

Further analysis of the behavior of respiratory disease in batteries of recruits appeared to support these concepts. The flow schedule of the training center was such that batteries were filled with recruits at regular intervals throughout the year. As a battery completed its basic training and left the post, a new battery was formed with recruits to replace it, thus providing a population inflow and outflow ideal for these studies. Figure 2 shows the behavior of respiratory diseases in four batteries during December and January of 1942-1943—a behavior which was typical during the winter months. These recruits arrived during the week of 11 December. Their hospitalization rates rose to a peak of about 140 per 1,000 per week in the third week of training and then declined rather sharply. By the end of 5 or 6 weeks there was little respiratory illness. But during that period about one third of the men had been hospitalized for respiratory illness and the period of hospitalization averaged 2 weeks. The interference with training is obvious.

The influence of season on this phenomenon was consistent during the 3 years of study. The sharpest outbreaks occurred in recruits arriving at the post during the winter months, as is illustrated in figure 3 for the period from October 1942 to January 1943. Recruits entering during the summer and early fall usually showed a delayed rise. Troops entering in the late spring would have little illness during the summer, but would experience a wave of illness in the fall. Thus the behavior was related to season, but not to the stage of training or to physical conditioning.

Finally, the undifferentiated respiratory diseases differed epidemiologically from other known entities. Figure 4 shows the occurrence of undifferentiated respiratory disease, influenza A, and type 12 streptococcal infections in a battalion of 1,000 men during the period from October 1942 to February 1943. Figure 5

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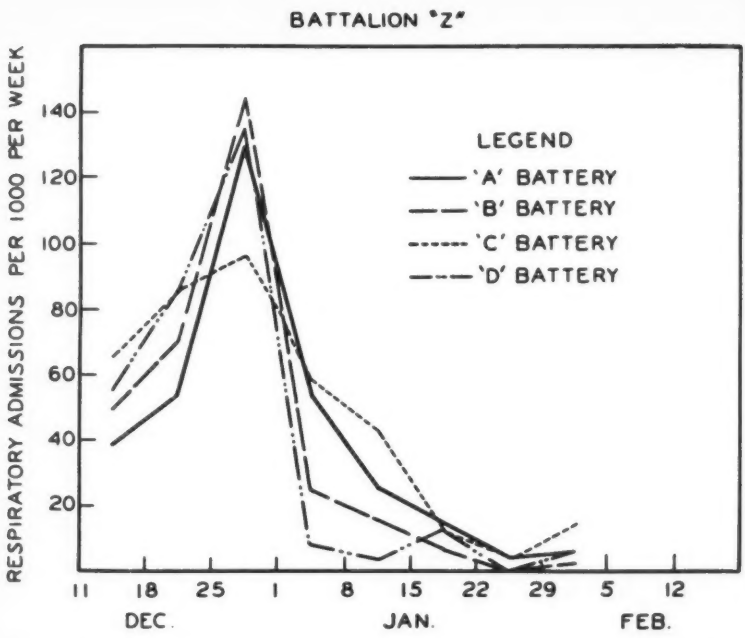


*Figure 2. Admission rates for respiratory disease for four batteries in a battalion of recruits in the Replacement Training Center from 11 December 1942 to 5 February 1943.*

shows the occurrence of undifferentiated respiratory disease and German measles in five battalions. German measles reached its peak during the same calendar weeks, whereas the peaks of respiratory disease varied in each battalion, depending on the time of its organization and arrival at the post.

Thus the epidemiologic data suggested that "undifferentiated respiratory disease" might be an entity that occurred in influenza-like epidemics in individual units of recruits during the winter months and did not affect seasoned men to an appreciable degree, possibly because of immunity.

The clinical features of these illnesses as seen in hospitalized recruits were those of a mild respiratory infection of gradual onset.[2] Feverishness, chilliness, and headache were the most frequent complaints. Malaise, anorexia, and symptoms of nasal involvement occurred in about half of the patients. Sore throat was common, but was mild in degree. Minimal hoarseness and cough were also common, although less than half of the patients had a productive cough or chest pain. Only rarely did the patients appear to be moderately or severely ill. Physical signs were

*Figure 3. Admission rates for respiratory disease for three battalions of recruits in the Replacement Training Center from 23 October 1942 to 2 July 1943.*

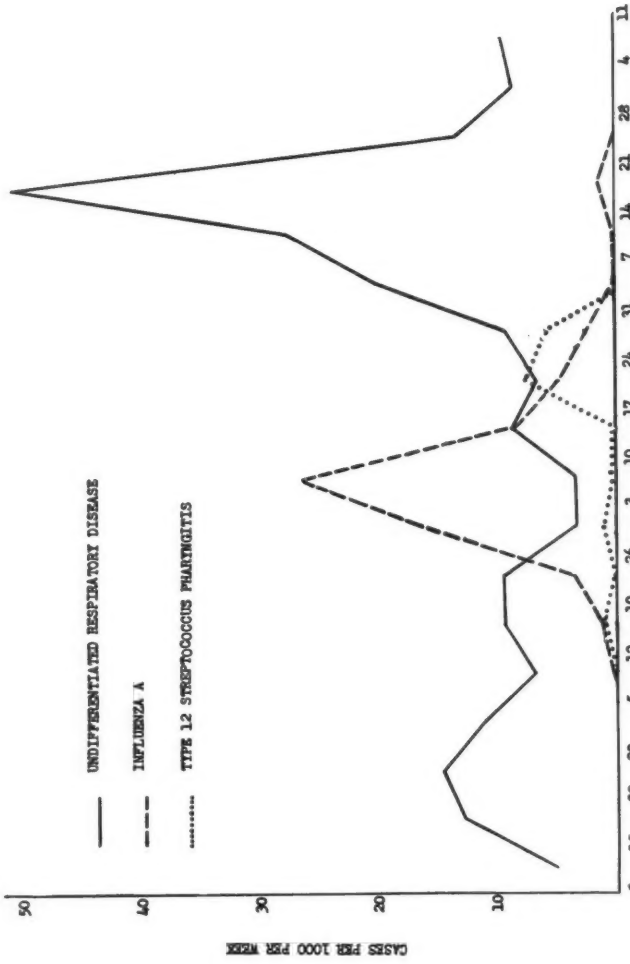


*Figure 4. Admission rates for undifferentiated respiratory disease, influenza, and streptococcus pharyngitis from a battalion of the Replacement Training Center from 8 October 1942 to 11 February 1943.*

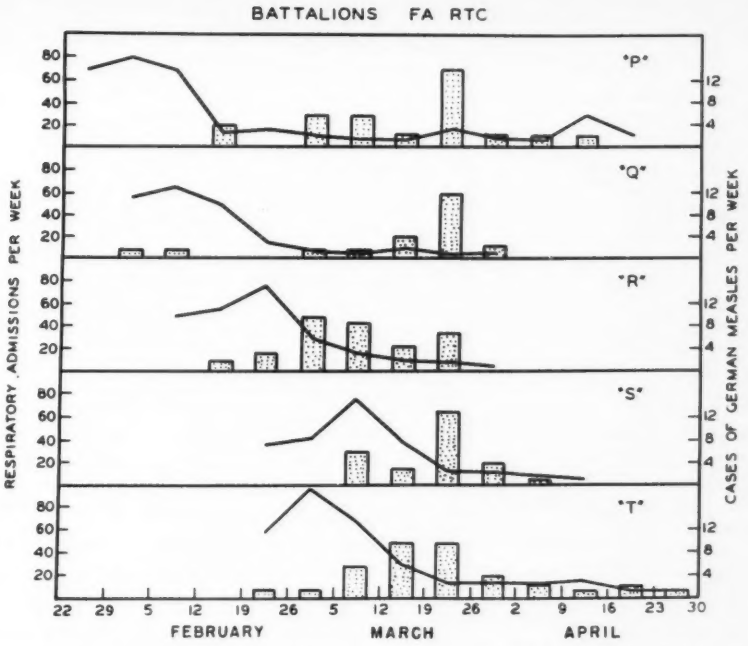


*Figure 5. Admission rates for respiratory disease and German measles from five battalions of the Replacement Training Center from 22 February 1943 to 30 April 1943.*

remarkably few, rarely of intense degree, and were noted in less than half of the patients. Nasal obstruction, mild injection of the pharynx and palate, and lymphoid hyperplasia on the pharyngeal wall were most frequently found. Edema of mucous membranes, cervical adenopathy, and pulmonary rales were present in about 10 to 15 percent of the patients. The febrile course was short, from 2 to 4 days, and the average maximum temperature was about 101° F. Constitutional symptoms subsided with defervescence, but symptoms referable to the respiratory tract, when present, tended to persist from 1 to 2 weeks. Leukocyte counts were within normal limits and cultures revealed only the normal bacterial flora of the respiratory tract.[2,3]

Many attempts were made to isolate an etiologic agent or to transmit this respiratory infection to animals. Known viruses, such as the influenza viruses, were not responsible, as indicated by the failure to isolate them and by the lack of serologic evidence. No virus could be isolated in chick embryos, nor could the infection be transmitted to experimental animals. Since a similar lack of success was attained with specimens from pa-

tients with the common cold and primary atypical pneumonia, a study in volunteers was performed.[4,5] Throat washings were collected from a donor who was a recruit and whose illness was typical of the recruit disease. After filtration to remove bacteria, these washings were sprayed into the noses and throats of 24 men, of whom 18 (75 percent) became ill. In most of the volunteers symptoms first appeared on the fifth or sixth day after inoculation. The symptomatology was somewhat variable, but the initial complaints were usually those of dryness or soreness of the throat which developed gradually over a period from 24 to 48 hours. Constitutional symptoms were minimal or absent; nasal symptoms were minimal; coryza was absent. Physical examination revealed very mild inflammation of the palate and pharynx, and lymphoid hyperplasia. No volunteer developed pulmonary infiltration either clinically or radiologically. The illnesses were mild, generally afebrile, and lasted from 4 to 12 days. Laboratory studies were within normal limits. These findings differed from those obtained with inocula from donors who had the common cold or primary atypical pneumonia with respect to incubation period, symptomatology, physical signs, and course of illness.

Reinoculation of six of these volunteers with washings from the same recruit donor produced no illnesses, indicating probable immunity. Subsequent inoculations showed no evidence of heterologous immunity to the common cold or to primary atypical pneumonia characterized by cold hemagglutinins.

Thus it was concluded that the disease in recruits was a clinical, epidemiologic, and possibly etiologic entity. The cause was presumably a virus. The disease was termed "Acute Respiratory Disease" or ARD. These studies confirmed and extended the knowledge, with which military men have long been acquainted,[6,7] that respiratory disease constitutes the major illness problem in recruit training. Other studies[8] have confirmed the essential features of this work.

Final proof of the conclusion that ARD is a distinct entity was still lacking, however, because it required the isolation of an agent that could be related etiologically to the disease. Here the problem remained until 2 years ago, when Hilleman and Werner[9] isolated, by tissue culture technics, a new virus, termed RI-67, from patients with a disease which occurred epidemically among recruits at Fort Leonard Wood, Mo., which resembled ARD. Complement-fixation and neutralization tests demonstrated that this virus was immunologically related to the disease diagnosed as ARD and to that occurring simultaneously in a smaller number of patients who had pulmonary infiltration but did not develop cold hemagglutinins or agglutinins to streptococcus MG.

*The memory of the late Brigadier General James Stevens Simmons, MC, USA (Ret.) will be honored annually at a "James Stevens Simmons Memorial Lecture," the first of which was given by Dr. John H. Dingle. General Simmons was born 7 June 1890 in Newton, N. C. He received his M. D. degree from the University of Pennsylvania School of Medicine in 1915, and a doctorate in public health from Harvard University in 1939. Commissioned a first lieutenant in the Army Medical Corps in July 1916, his assignments included the presidency of the Army Medical Department Research Board in Manila and, later, in the Canal Zone, and directorship of the Department of Preventive Medicine of the Army Medical Service Graduate School. As chief of the Preventive Medicine Service, Office of the Surgeon General, he was responsible for the development of a program that greatly benefited the health and welfare of over 9,000,000 soldiers during World War II. He drew up the plans for what is now called the Armed Forces Epidemiological Board. The President of Cuba decorated him with the Carlos J. Finlay National Order of Merit in 1944, and in 1945 the U. S. Army awarded him the Distinguished Service Medal. At the time of his death, 31 July 1954, he was dean and professor at the Harvard School of Public Health.*

Hilleman's results were readily confirmed in our laboratories. Moreover, it was possible to reappraise the volunteer studies of 1944 and 1945, because sera had been stored from the donors and recipients of the various inocula used in these experiments.[10] Acute and convalescent sera from the donor of the ARD inoculum showed a rise in neutralizing antibodies to the RI-67 virus; those from the donors of the common cold and primary atypical pneumonia inocula did not. Examination of the pre- and post-inoculation sera of the recipients showed that 20 of the 24 volunteers who received the ARD inoculum showed a rise in neutralizing titers for the RI-67 virus (table 1). In contrast, no changes in

TABLE 1. *Results of neutralization titrations with the RI-67 strain of ARD virus and pre- and post-inoculation sera of the recipients*

| Inoculum | Neutralization titer rise* |
|---|---|
| Acute respiratory disease (ARD) | 20/24 |
| Primary atypical pneumonia | 0/15 |
| Common cold | 0/35 |

*Numerator = number showing antibody rise
Denominator = number tested

titer occurred in the sera of the 15 volunteers who received the primary atypical pneumonia filtrate or in those of the 35 volunteers who received the common cold filtrates. Thus only the ARD filtrate was associated with the development of antibodies to the RI-67 virus. The correlation between the presence or absence of RI-67 antibodies in the preinoculation sera and the occurrence of ARD in the volunteers was excellent (table 2). Of the 18 volunteers who became ill after inoculation, 15 had no detectable antibody in their preinoculation sera and all showed rises in titer. Three men who became ill had antibodies before inoculation, but two of them showed increases in titer; only one person who became ill had antibodies before inoculation and failed to develop an increase in titer. In contrast, of the six men who did not become ill, five had antibodies in their preinoculation sera and two of these had increases in titer. One person had no antibodies before inoculation and remained well, but he also showed a rise in titer. Expressed another way, illnesses occurred in 15 of the 16 men who had no detectable antibodies at the time of inoculation, whereas illness failed to develop in five of the eight men who had antibodies. No relationship existed between the presence or development of antibodies to the RI-67 virus and the results of inoculation with the common cold and primary atypical pneumonia inocula.

Some information has been obtained regarding the immunologic association of the RI-67 virus to cases of ARD occurring in military installations back to 1942 (table 3). It is apparent that a large proportion of the patients from whom sera were available,

TABLE 2. *Correlation of RI-67 neutralizing antibodies in preinoculation sera of recipients with the occurrence of ARD*

| Antibody preinoculation sera | Results of inoculation with ARD filtrate | |
|---|---|---|
| | Number ill | Number not ill |
| Absent | 15 | 1 |
| Present | 3 | 5 |

at Fort Bragg in 1942 and at Sampson Air Force Base in 1953, showed rises in neutralizing antibodies to the virus. These cases at both posts occurred during the course of sharp epidemics of ARD in recruits. A lower proportion of antibody responses was found at Fort Bragg in 1944 and 1945, but many of these cases occurred during interepidemic periods or at times of low incidence.

TABLE 3. *Neutralization titrations with the RI-67 strain of ARD virus and acute and convalescent sera from patients whose illnesses were diagnosed as ARD at military installations*

| Camp | Year | Antibody rise* |
|---|---|---|
| Ft. Bragg, N. C. | 1942 | 10/12 |
| | 1944 | 8/35 |
| | 1945 | 1/12 |
| Warren Air Force Base, Colo. | 1949 | 1/3 |
| | 1951 | 0/4 |
| Sampson Air Force Base, N. Y. | 1953 | 13/21 |

*Numerator = number showing antibody rise
Denominator = number tested

Only one of seven patients diagnosed as having ARD at Warren Air Force Base in 1949 and 1951 had an antibody response. The men at this post, however, had completed their basic training before arrival and could no longer be considered as recruits. More extensive surveys have been carried out by Hilleman and associates[11] in 1952, 1953, and 1954. The majority of patients in recruit training centers showed antibody responses, particularly those whose illnesses occurred in the fall and winter. Little or no evi-

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dence of the disease was found at two posts occupied by "seasoned" troops.

The etiologic studies thus support the conclusion that ARD is indeed a clinical, epidemiologic, and etiologic entity. At least one causative agent, and possibly the principal one as far as epidemic occurrence is concerned, is the RI-67 virus of Hilleman and Werner. Thus far, at least, the new cytopathogenic agents isolated by Rowe and associates[12] and Huebner and co-workers[13] from human adenoids and tonsils have not been associated with epidemics of ARD by neutralization tests. It seems probable, however, that viruses other than the RI-67 strain may cause ARD.

The association of ARD with recruit populations raises the interesting question of the origin of the infection. Is it a disease peculiar to military life, stimulated in its occurrence by the congregation of a susceptible population of recruits, or does it exist also in civilian life? It is most reasonable to believe that it exists among civilian populations. Yet in a study of civilian families in Cleveland, now in its eighth year, ARD has not been recognized with certainty either clinically or epidemiologically. Nor has an RI-67 strain of virus been isolated from an illness. Examination of seven different lots of gamma globulin prepared from Red Cross pooled plasma, however, revealed neutralizing titers of 32 to 128 for the RI-67 virus in all of them, suggesting that this agent or an immunologically similar one had infected many of the donors.[10] A serologic survey of the Family Study population in the spring of 1954 showed that a third of the adults, but none of the children (who varied in age up to 17 years), had neutralizing antibodies for the virus (table 4).[14] The sex distribution among the adults was not equal, but no correlation could be found with prior military service. The results suggest that the RI-67 type of virus has not been active in this Cleveland population during the past 17 years. Huebner and associates,[13] however, have isolated some strains of the RI-67 type, so that this virus presumably does exist in civilian populations. It remains to be determined whether or not epidemics of ARD due to this virus can occur apart from unusual population movements such as the induction and training process.

The final aspect of ARD to be considered is that of prevention and control. Numerous attempts have been made to control the common respiratory diseases in military populations. Several studies have been based on procedures designed to prevent or reduce contamination of the air and the air-borne spread of infection, such as the use of double bunks,[15] oiling of floors and blankets,[16] ultraviolet irradiation, and glycol vapors.[7,17-19] At times such procedures have appeared to reduce the incidence of respiratory diseases, but the results have not been consistent

and the degree of reduction has been too small to warrant application of these methods.

TABLE 4. *The presence of neutralizing antibodies for the RI-67 strain of ARD virus in sera obtained from the members of a group of Cleveland families in the spring of 1954*

| Subjects | Number tested | Antibody present | |
|---|---|---|---|
| | | Number | Percent |
| Children | 73 | 0 | 0.0 |
| Adults | 84 | 29 | 34.5 |
| Mothers | 43 | 7 | 16.3 |
| Fathers | 41 | 22 | 53.7 |
| Total | 157 | 29 | 18.5 |

The use of immunization appears to hold the greatest potentiality for the prevention of ARD in recruits. As already pointed out, the epidemiologic behavior of ARD suggests that relatively firm group immunity develops in a population that has experienced an outbreak—a phenomenon which is probably a major part of the "seasoning" process.[1] Immunity in the individual person was demonstrated by challenge inoculation in the volunteer studies.[8] Moreover, susceptibility or resistance to clinical infection was correlated directly with the absence or presence, respectively, of circulating neutralizing antibodies for the RI-67 strain of virus, and such antibodies developed during convalescence.[10] The RI-67 strain of virus, at least, appears to be a good antigen. On theoretical grounds, therefore, active immunization should be effective. Work on the production and evaluation of a vaccine is now in progress in several laboratories.

Consideration should also be given to the use of passive immunization for the prevention of ARD in recruits during winter months. At that time of year inductees may arrive at training centers with respiratory disease rates already elevated and may experience an epidemic during the next 2 to 3 weeks.[1] Thus sufficient time might not be available for active immunization to be effective. As already mentioned, several lots of human gamma globulin have been shown to contain high titers of neutralizing antibodies for the RI-67 strain of ARD virus.[10] It is possible that selective passive immunization of recruits with gamma globulin could prevent or greatly modify the epidemic occurrence of ARD. It is hoped that this procedure can be evaluated in the near future.

In conclusion, it now appears probable that at least a partial solution to the problem of ARD in recruits may well be at hand.

The accomplishment of this goal will indeed represent a tribute to the vision and leadership of General Simmons.

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# EXPERIENCES IN CARDIOVASCULAR SURGERY

## II. Mitral Stenosis; Atrial Septal Defect; Miscellaneous*

WELDON J. WALKER, *Lieutenant Colonel, MC, USA*
WARNER F. BOWERS, *Colonel, MC, USA*
HENRY C. HARRELL, *Colonel, MC, USA*
CLESTON W. GILPATRICK, *Major, MC, USA*
JOHN E. COLES, *Captain, USAF (MC)*
RICHARD F. BARQUIST, *Captain, MC, USA*
GARTH B. DETTINGER, *Captain, USAF (MC)*
DONALD FAHY, *Major, MC, USA*
THEODORE H. NICHOLAS, *Major, MC, USA*
RALPH H. FORRESTER, *Major, MC, USA*

### A. MITRAL STENOSIS

RHEUMATIC heart disease results from an altered antibody response to infection by group A beta hemolytic streptococci, and in the chronic form involves primarily the mitral and aortic valves. In the past all forms of rheumatic heart disease accounted for about three percent of deaths from heart disease; a figure approximating the total number of deaths from all forms of congenital heart disease. The incidence of rheumatic heart disease is declining. It is now about half what it was 20 years ago, and with better treatment and prevention of streptococcal infections one can confidently predict an even greater decline in the next 20 years.

Mitral stenosis is from two to three times as common in women as in men. Pathologic physiologic findings in this condition are illustrated in fig. 6. The normal mitral valve area is from four to six square centimeters. It is in direct communication with the pulmonary capillaries via the pulmonary veins, without the benefit of intervening valves or baffles. As the mitral valve contracts, certain compensatory mechanisms must take place if the cardiac output is to be maintained through this narrowed opening. The first compensation is a rise in pressure in the left atrium and pulmonary capillaries. Another is a decrease in the cardiac output, with the tissues extracting a greater portion of the oxygen from the circulating blood. These means of compensation are limited, however, because the pressure cannot rise much above

From Brooke Army Hospital, Fort Sam Houston, Tex. Presented as a symposium at the monthly staff meeting on 9 November 1954.

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30 mm. Hg lest it exceed the osmotic pressure of the serum proteins with resulting pulmonary edema. The early symptoms of tight mitral stenosis are exertional dyspnea, orthopnea, hemoptysis, attacks of acute pulmonary edema without a grossly enlarged heart, venous distention, and hepatomegaly or other

DIAGRAM OF PATHOLOGIC PHYSIOLOGY OF MITRAL STENOSIS

*Figure 6. Pathologic physiologic findings in mitral stenosis. (Reproduced with permission from: Dexter, L.: Pathologic physiology of mitral stenosis and its surgical implications.* Bull. New York Acad. Med. *28: 90-105, Feb. 1952.)*

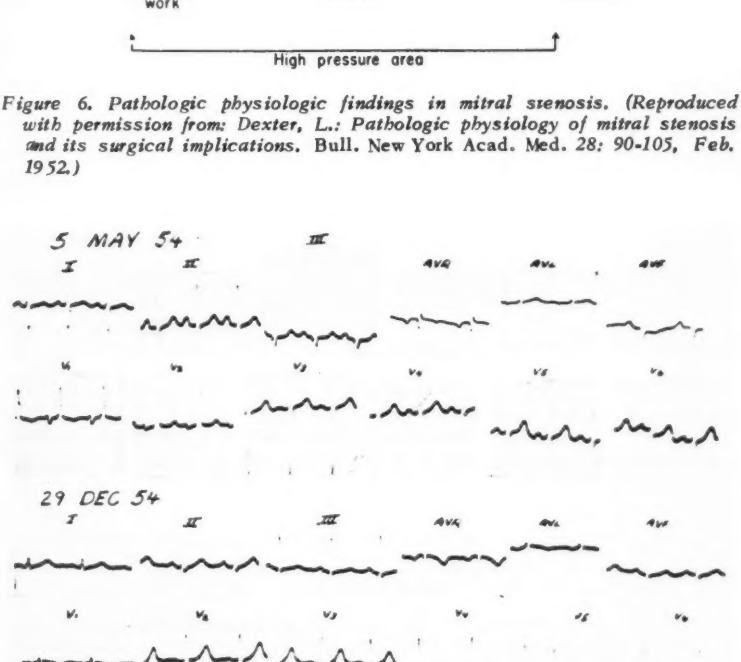


*Figure 7. Electrocardiograms before and after mitral commissurotomy. Evidence of right ventricular hypertrophy has disappeared. The changes in leads I and $V_1$ are most striking.*

evidence of right heart failure. When the mitral valve area decreases to about 1 sq. cm. in area, a third compensation appears, namely, narrowing of the arterioles and small arteries in the lung with proliferation of the intima and hypertrophy of the media of these vessels. This increased pulmonary resistance prevents the right ventricle from pumping an increased amount of blood into the lungs on exertion and, although respiratory symptoms may improve, there is a low, fixed cardiac output characterized by weakness, exhaustion, fatigue, enlargement of the right heart and pulmonary artery, eventual peripheral venous engorgement, hepatomegaly, and edema. These pulmonary vascular changes seem to be at least partially reversible if mitral stenosis is corrected.

The most reliable, and incidentally the most economical, method of diagnosing mitral stenosis is by recognizing the characteristic low-pitched diastolic rumble, like distant thunder, at the apex. Contrary to its description in most texts it nearly always has an early diastolic component, which if present establishes the diagnosis. If one imagines the second heart sound as caused by a stick striking a drum, it will sound as though the stick is loose and is continuing to vibrate, thus producing a low-pitched rumble. In addition, the apical first sound is accentuated and, if there is sinus rhythm, is preceded by a crescendo presystolic rumble. However, one needs the early diastolic rumble to make the diagnosis from auscultation alone, because a split first heart sound can simulate a crescendo presystolic murmur. The early diastolic murmur of mitral stenosis does not have the high-pitched blowing character of other cardiac murmurs, and many physicians even fail to recognize it as a murmur.

Figure 7 illustrates a rather characteristic electrocardiogram with evidence of right ventricular hypertrophy in a patient with a tight mitral stenosis. The electrocardiogram reverted to normal following mitral commissurotomy. Particularly noteworthy are the regression of the S wave in lead I, the decreased R wave in lead $V_1$, and the decrease in size of the broad prominent P waves.

Surgical intervention is recommended if the patient has significant disability from his disease and if mitral stenosis is thought to be the primary valvular defect. Age is no contraindication to operation.

## ROENTGENOGRAPHIC FINDINGS

The most important roentgenographic sign of mitral stenosis is an enlarged left atrium. The same weight should be attached to this finding as to hearing the characteristic murmur. Atrial enlargement may be shown in several different ways, but may be

apparent on the roentgenogram of the chest as seen in figure 8. This illustration is characteristic of the heart silhouette as seen in a typical case of mitral stenosis. The straight left border results from enlargement of the pulmonary artery. The whole pulmonary artery is enlarged, but it is the left branch that causes this border of the heart to lose its concavity. A relatively small aortic knob also contributes to the apparent straight left border of the heart. The double density seen through the heart shadow on each side of the spine is caused by the enlarged left atrium. It is relatively uncommon for it to be as well demonstrated as in this case.

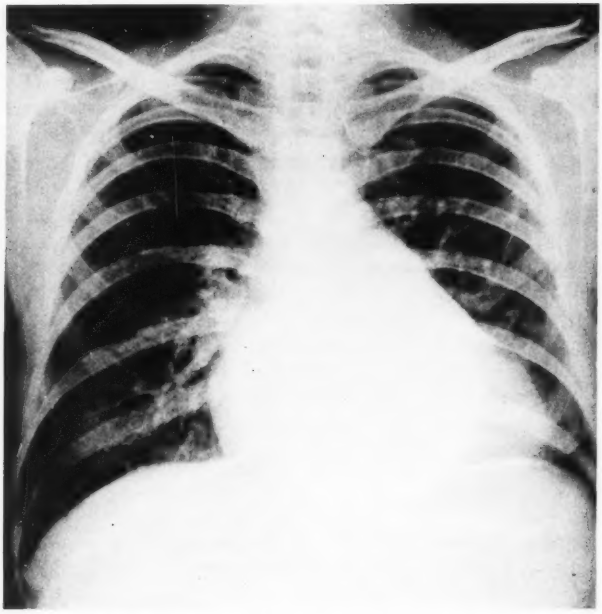

*Figure 8. Roentgenogram of patient with mitral stenosis. The greatly enlarged left atrium causes double density.*

The left atrium enlarges in all directions and displaces the esophagus backward and to the right. Displacement of the barium-filled esophagus should be the first sign sought in the roentgenographic study of patients with a suspected lesion. Another common finding is elevation of the left main bronchus with resulting widening of the carina.

The right ventricle enlarges and eventually contributes a great deal to the over-all cardiac size. The left ventricle may be smaller than normal due to the decreased cardiac output.

Angiocardiography reveals poor visualization of the left ventricle because of a "hold up" of opaque material in the left atrium. The intracardiac circulation time may be increased markedly. In one of our patients it was three and one-half seconds after the left atrium filled before an appreciable amount could be shown in the small left ventricle (fig. 9).

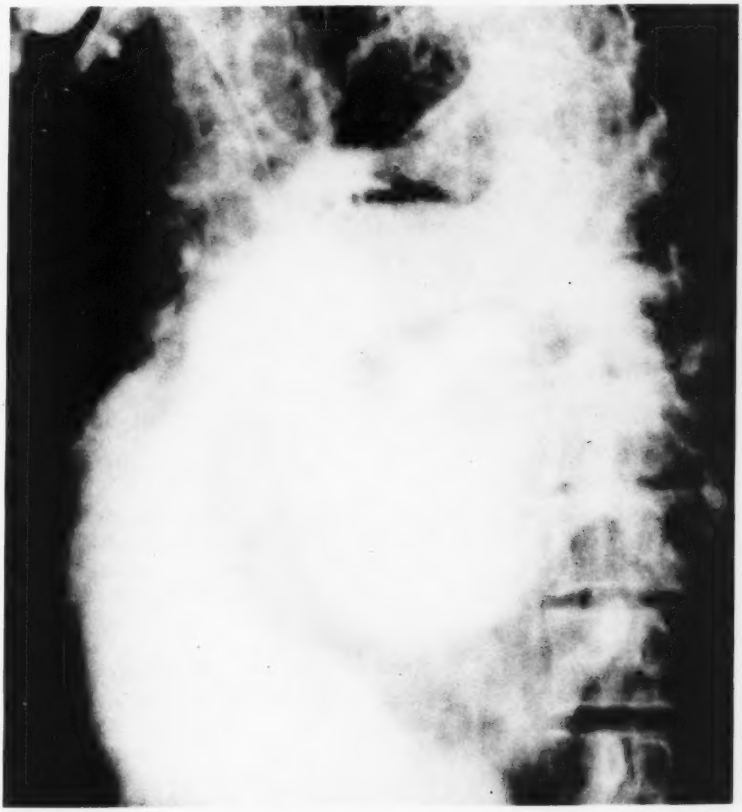

*Figure 9. Angiocardiogram in left anterior oblique view, showing opacification of right ventricle, pulmonary artery, and left atrium. The "hold up" of radiopaque material in the left atrium is demonstrated and the small left ventricle is poorly visualized. This is a characteristic angiocardiographic finding in tight mitral stenosis.*

## SURGICAL CONSIDERATIONS

In an anterolateral position, the left side of the chest is opened, the pericardium is incised, and two purse-string sutures are placed about the base of the left auricular appendage. After the clamp has been placed and the top of the appendage

has been amputated, the clamp is loosened to allow free bleeding. If no clots are present, the operation can proceed. In our series, we have not encountered clots in the appendage nor the chamber. When the index finger is introduced the valve orifice is felt for size, location, consistency, and regurgitation. In our experience minor regurgitation has been corrected by opening the valve so that it can function more normally. We have not encountered a jaggedly calcified valve nor, to our knowledge, has an embolus occurred in any of our patients. In each case we have employed the finger fracture method and have not used the various valvulotomes. We usually have found a fibrotic valve and have broken it open more anteriorly than posteriorly to avoid the aortic area. Equally important is the protection of the coronary artery on the ventricular surface and the prevention of rupture of the atrial or ventricular wall with the finger. Also, the finger must not catch and tear the chordae tendineae which are so important in valve function. The tip of the index finger is wrapped with umbilical tape to a circumference of 7.5 cm. and then another glove is put on over this. Thus a "standard" finger is produced and when this is pushed through the valve, we know that it has been opened to a 2.5 cm. diameter. Furthermore, in fibrotic valves, the obturator goes through fairly easily and causes less trauma to the heart wall. We proceed carefully, making sure that progressive opening of the valve is not causing or increasing regurgitation. The working finger is kept in the valve orifice for very short periods of time. When the valve is opened, we tie down the purse-string suture as the finger is withdrawn, and the cut edges of the appendage are closed by several interrupted sutures. We have not found carotid compression necessary nor desirable.

## RESULTS

The first mitral commissurotomy was performed at this hospital on 8 September 1952. Since then, 21 such operations have been performed. There are two categories of patients on whom this procedure has been carried out: (1) Pure mitral stenosis (16 cases), and (2) mitral stenosis with regurgitation (5 cases).

Of the 16 patients with pure stenosis, the valve in each was 0.8 to 1.0 cm. in diameter or less before commissurotomy, and was opened to 2.5 cm. in diameter, or 7.5 cm. in circumference. Calcification was considered to have been present in two patients and the chordae tendineae were thought to be mildly involved in one. There were no operative or postoperative deaths in this series. Postoperatively, however, two patients developed complications, one having a recurrence of rheumatic activity and the other having a pericarditis and, later, complete subsidence of all activity. Follow-up on these 16 patients ranged from three months to two years. There are six patients in whom

it was too early for a follow-up report, but they were reported to be doing well. Of the remaining 10 patients, two were taking digitalis but remained physically active, seven patients reverted to complete activity, and one patient did not have a follow-up because she signed out of the hospital and was reported to be working as a waitress two weeks later. Postoperatively, all patients were placed on a course of penicillin, given orally.

Of the five patients with mitral stenosis and regurgitation, the valve in each patient admitted the finger easily, although there was a fusion of the commissures to some extent in all cases. Calcium was reported to have been present in one patient, and the posterior leaflet of the mitral valve was described as absent in another. The commissures of three patients were split, with an increase in regurgitation in two of these and no change in the other. In two of the patients, no anatomic change was effected. There were no operative or postoperative deaths among these five patients. Three, however, had recurrences of cardiac failure. In addition to this, one of these three patients developed severe hepatitis and another one had pneumonia. Two of the patients had a relatively uncomplicated course. Follow-up studies again ranged from three months to two years. It was too early to report the follow-up on one of these patients; the other four were all on reduced physical activity and required digitalis and other cardiac medication. It was believed that in this group of patients beneficial results had not been obtained.

In summary, the patients with pure mitral stenosis were all considered to have benefited from their operation, whereas no benefit was demonstrable in those with mitral stenosis and regurgitation. In the entire series there were no operative or postoperative deaths.

TABLE 2. *Pre- and post-operative cardiac catheterization findings in patients with mitral stenosis*

| Case number | Preoperative right ventricular pressure | Postoperative right ventricular pressure | Interval between studies (months) |
|---|---|---|---|
| 1 | 88/6 mm. Hg | 29/6 mm. Hg | 5 |
| 2 | 105/5 mm. Hg | 87/2 mm. Hg | 5 |

## CATHETERIZATION DATA

Two patients with mitral stenosis had pre- and post-operative catheterization studies (table 2).

The time interval between the preoperative and postoperative studies may not have been long enough to allow for maximum

improvement. This limited experience, together with the reports in the literature, indicated that pulmonary hypertension is reversible following corrective cardiac surgical intervention. The improvement in the abnormal cardiac dynamics was important evidence that the good clinical results of mitral valvulotomy are in fact due to the operative procedure and are not, as some have suggested, the result of increased rest, better medical management, and suggestion.

### B. ATRIAL SEPTAL DEFECT

Atrial septal defect, according to Taussig,[8] is the most common congenital malformation of the heart in young adults and the one most often incorrectly diagnosed. About half the patients with this disorder have symptoms of decreased exercise tolerance from birth associated with frequent chest colds, while the other half get along well until about 20 years of age, at which time they often manifest pulmonary symptoms. Their average life expectancy is relatively good, about 40 years, which is better than for most forms of congenital heart disease, but is still nearly 30 years below average. Atrial septal defect is a killer, but a slow killer. The disorder occurs two or three times as frequently in women as in men; most of these patients tend to be small and poorly nourished, perhaps due to the decreased systemic blood flow. They do not manifest clubbing, and cyanosis is usually observed only as a terminal event when the right heart fails, resulting in a right-to-left shunt. Frequently, these patients have substernal pain on exertion which is relieved by rest but not by nitroglycerin and is probably the type of pain recently described by Viar and Harrison[9] as due to distention of the pulmonary artery.

The usual cardiac findings are an accentuated second pulmonic sound and a systolic murmur of varying intensity in the pulmonic area; about half of the patients have a thrill in this region. The murmur appears to originate in the pulmonary artery, not at the site of the atrial defect. Turbulence is caused by the marked increase in pulmonary blood flow through a dilated pulmonary artery that lies in close proximity to the anterior chest wall. Dilatation of the pulmonary ring may cause pulmonic insufficiency with a resulting high-pitched diastolic murmur along the left sternal border. Occasionally, an apical diastolic rumble is heard, perhaps due to the large amount of blood that enters the heart during each diastolic pause.

The mechanisms involved in producing the clinical picture center around the tremendous left-to-right shunt that takes place through the defect which usually exceeds 2 cm. in diameter. The mean pressure in the left atrium is normally 2 to 4 mm. Hg greater than in the right. The tendency for left-to-right shunting of blood

is further enhanced by the fact that the tricuspid valve is much larger than the mitral valve. It normally will admit four fingers as against two for the mitral valve; consequently, the right ventricle fills more quickly than the left and, because of its thinner wall, is more readily distended by the pressure from what, in effect, is a common atrium. The large systolic output from the right ventricle distends the pulmonary arteries and produces the characteristic hilar dance seen on fluoroscopic examination. In spite of the large pulmonary blood flow the majority do not develop significant pulmonary hypertension until late in their disease, and in this event their prognosis becomes poorer.

Rushmer and others[10] recently afforded an explanation as to why these patients often do so well in spite of the fact that the right ventricle is pumping tremendous volumes of blood. The left ventricle has the form of a concentric cylinder, which is the ideal form for a pressure pump. On the other hand the free wall of the right ventricle is draped around the convex surface of the interventricular septum like a bellows, which is an ideal arrangement for a volume pump but ineffective for a pressure pump. Rushmer and associates demonstrated that, in fact, the right ventricle normally contracts in the manner of a bellows.

Unlike other forms of congenital heart disease, atrial septal defect is only infrequently complicated by subacute bacterial endocarditis.

Short of surgical exploration a conclusive diagnosis of atrial septal defect can be made only by passing the cardiac catheter through the defect. A reasonably sure presumptive diagnosis can be made, however, by demonstrating an increased oxygen content of the blood in the right atrium as compared with samples from the vena cava, but anomalous pulmonary veins draining into the right atrium could produce the same findings.

## ROENTGENOGRAPHIC FINDINGS

This is another heart lesion characterized by a marked increase in blood volume flowing through the lungs. Enormous enlargement of the pulmonary artery is characteristic of this disease. The right branch may be particularly prominent on the chest roentgenogram (fig. 10). Aneurysm at this site occurs not uncommonly. Widening of the carina may result from an enlarged pulmonary artery.

There is often a marked increase in the size of the heart, which is largely contributed by dilatation of the right ventricle. The left ventricle and aorta are small by comparison.

The retrocardiac space remains clear because there is no enlargement of the left atrium. The right atrium, on the other hand, ordinarily enlarges almost as much as the right ventricle. This

is an important point in differentiating this condition from patent ductus arteriosus.

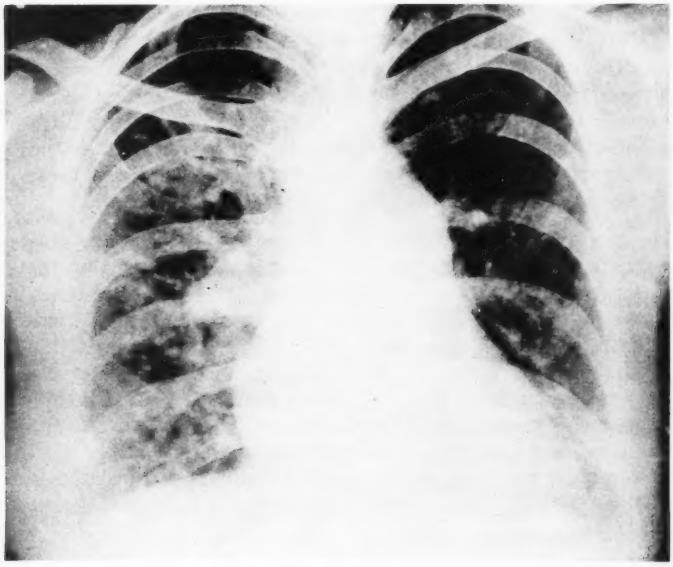

*Figure 10. Enlargement of the right pulmonary artery to nearly aneurysmal proportions, prominence of the right atrium, and increased pulmonary vascularity are evident in this roentgenogram of a patient with atrial septal defect.*

Cardiac catheterization (fig. 11) is particularly valuable in interatrial septal defect, not only for the abnormal physiologic findings demonstrated, but also for the passage of the catheter through the defect.

## SURGICAL CONSIDERATIONS

Our first four patients were operated on by Dr. Charles P. Bailey, Philadelphia, Pa., who used his doughnut procedure of suturing the anterior atrial wall to the edges of the septal defect. This procedure may interfere with blood flow from the superior vena cava but was technically successful in our patients. The remaining patients were operated on by Dr. John J. Kralik and one of us (WFB). At first we used the Crafoord stitch, which is introduced between the superior vena cava and the aorta, and passes down through the edge of the septum and its defect to emerge near the inferior vena cava. The ends of the suture are passed behind the inferior and superior cavae and, when tied snugly, the defect is obliterated. It is difficult to place this stitch correctly and we were reluctant to depend on

one silk suture for our repair. At about this time, Gross and Watkins'[11] article was published and we supplemented the Cra-

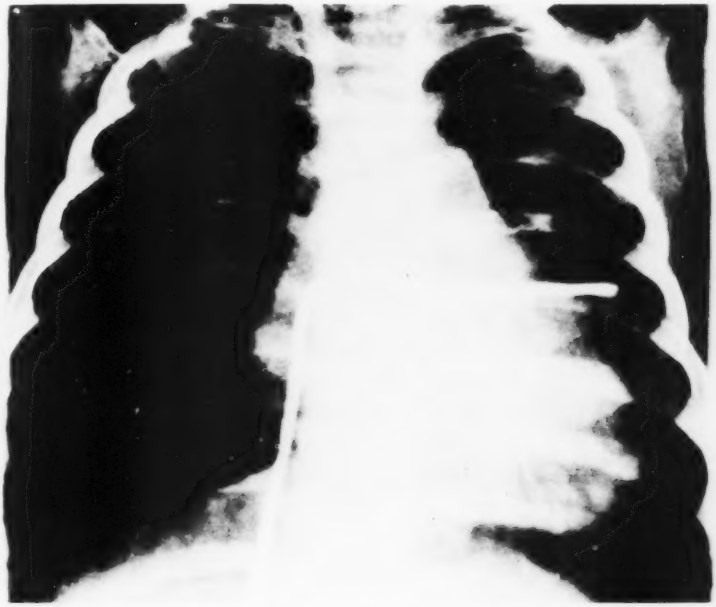

*Figure 11. Cardiac catheterization in a patient with interatrial septal defect. The catheter extends from the right atrium through the septal defect and left atrium, and into a pulmonary vein.*

foord stitch with several mattress sutures of the Gross type to support the closure. Next, we abandoned the original Crafoord stitch and used only the Gross stitches to bring the edge of the septal defect over to the atrial wall laterally (fig. 12). This is somewhat difficult because the tugging of the cardiac impulse tends to tear the needle through the septal edge, especially when, as in several of our patients, the septum is entirely a membranous structure. Our postoperative follow-up seems to indicate that those sutures may subsequently tear through and it is our opinion that an open procedure under direct vision with a quiet heart will be the final answer to the problem. We have postponed further operations for closure of septal defects pending further developments in this highly technical field.

## RESULTS

At this installation in the past 12 months, 11 persons have been operated on for interatrial septal defects. These were seven women, ranging in age between 21 and 35 years; two girls aged

eight and 13 years; one man aged 21 years; and one boy aged four years. In nine patients the defects were successfully closed, while in the remaining two (both adult females) the operation was limited to exploratory thoracotomy. In one of these, cardiac exploration was not performed because of marked bleeding tendency associated with diminished prothrombin concentration, which would have made suturing of the septum very hazardous. In the second patient, the anomalous drainage of the majority of the segmental veins of the right lung separately into the superior vena cava and right atrium necessitated abandonment of the procedure.

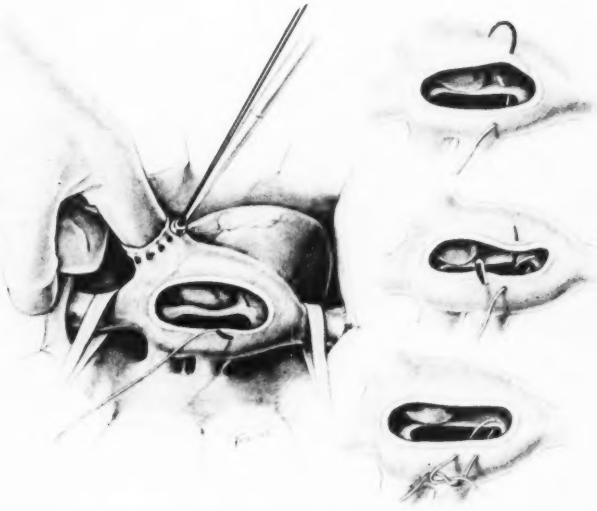

*Figure 12. Technic of closing atrial septal defect by the Gross method.*

## INDICATIONS

All patients had symptoms referable to the atrial defect preoperatively. Four of these patients had, at this time or in the past, right ventricle failure. All patients presented findings of a significant left-to-right shunt with arteriolization of the right atrial blood, and all had some degree of pulmonary hypertension. In two of these patients systolic pressure in the right ventricle and pulmonary artery exceeded 100 mm. Hg.

## FINDINGS

Of the nine patients subjected to intracardiac exploration, interatrial septal defects were found in all, ranging in size from 2.5 to 4.5 cm., while in three patients two defects were present.

All defects were of the foramen secondum type, except for the presence of a persistent ostium primum in the four-year-old boy. The latter case was the only one in which there was significant question regarding completeness of the closure.

## COMPLICATIONS AND FOLLOW-UP

There was no mortality in the series and the early complications were associated with transient cardiac irregularities, such as auriculoventricular block or atrial flutter occurring in about four of the patients. In two instances, incomplete auriculoventricular block has persisted since the operation. Three remote complications were recorded in clinic records. One patient developed subacute bacterial endocarditis three weeks postoperatively. She was treated with massive doses of antibiotics for six weeks and recovered. Follow-up examinations showed satisfactory improvement, but the patient remained nervous and very heart-conscious. A second patient developed pneumonitis and pleurisy of the left lung six weeks postoperatively which might have been entirely unrelated to surgical intervention. He recovered completely and was asymptomatic and on full activity one year postoperatively. A third patient developed pericarditis with effusion two months postoperatively. This was thought to be a reactivation of tuberculous pericarditis, although this was never proved. She improved under antimicrobial therapy and is now at home under continuing therapy. Her condition does not appear to have been improved by operation.

In general, seven patients showed improvement following operation. The four-year-old patient who had a persistent ostium primum failed to show significant improvement postoperatively and there was doubt that complete closure of the defect had been accomplished.

## ELECTROCARDIOGRAPHIC PATTERNS

It has been reported in the literature[4] that the incidence of abnormal electrocardiographic findings is high in congenital heart disease, and that patients with atrial septal defect have a high incidence of incomplete right bundle branch block. It therefore seemed worth while to study the cases of uncomplicated atrial septal defect which have been proved by catheterization at this hospital and identify the types of electrocardiographic patterns that were present.

For the purposes of this study, electrocardiograms were classified as showing incomplete right bundle branch block provided the typical pattern was present without regard to the duration of the QRS complex. Figure 13 is a reproduction of the electrocardiogram of one of the patients of this study, illustrating the typical findings of incomplete right bundle branch block. There

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is an S wave in lead I, an RR' in the right precordial leads, and a persistent S wave in $V_6$. In addition there is, in this case, a slight prolongation of the QRS to 0.10 sec.

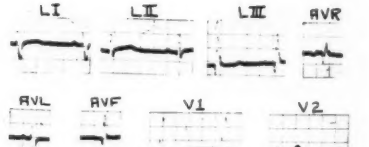


*Figure 13. Electrocardiogram showing incomplete right bundle branch block in a patient with an atrial septal defect.*

At the time of this study there were 22 patients with the diagnosis of uncomplicated atrial septal defect, and findings in these cases formed the basis for the data shown in table 3.

TABLE 3. *Electrocardiographic findings in 22 patients with atrial septal defect*

| Electrocardiographic findings | Number of patients |
|---|---|
| Incomplete right bundle branch block | 16 |
| Right ventricular hypertrophy | 4 |
| Complete right bundle branch block | 1 |
| Normal tracing | 1 |
| Total | 22 |

In conclusion, the electrocardiogram is a particularly valuable adjunct to the study of patients with this defect. A normal electrocardiogram casts considerable doubt on a presumptive diagnosis of atrial septal defect. On the other hand, a pattern of incomplete right bundle branch block definitely supports such a clinical impression. Finally, these data are in general agreement with those in the literature.

## CATHETERIZATION DATA

Of the nine patients with atrial septal defect who were surgically treated at this hospital, four were catheterized postoperatively (table 4).

Baker and others[12] observed that lowering of the abnormally high right ventricular and pulmonary artery pressure may continue for from 12 to 18 months. Therefore, these studies may not indicate the maximum improvement in these patients.

### C. OTHER CARDIOVASCULAR OPERATIONS

**Tetralogy of Fallot.** Eight patients were operated on for varying degrees of cyanosis in an attempt to secure greater pulmonary blood flow. No patient, no matter how serious his condition, was denied operation if there seemed to be a remote chance of offering even partial relief. Two patients died. We used either the left or the right approach, anastomosing the subclavian artery to the pulmonary artery, usually end-to-side but occasionally end-to-end with a large branch. We did not perform the procedure bilaterally.

TABLE 4. *Pre- and post-operative cardiac catheterization findings in patients with atrial septal defect*

| Case number | Preoperative | | Postoperative | | Interval between studies (in months) |
|---|---|---|---|---|---|
| | Right ventricular pressure | Shunt | Right ventricular pressure | Shunt | |
| 1 | 25/0 mm. Hg | 4.5 L/min. | 16/2 mm. Hg | None | 5 |
| 2 | 40/0 mm. Hg | 4x systemic flow | 26/7 mm. Hg | None | 3 |
| 3 | 45/0 mm. Hg | 4.2 L/min. | 23/0 mm. Hg | None | 9 |
| 4 | 102/4 mm. Hg | 2.9 L/min. | 50/0 mm. Hg | None | 5 |

**Pulmonary Stenosis.** In six patients, pulmonary stenosis was attacked directly by the Brock technic[13] of incision and dilatation. No deaths occurred in this group.

**Aortic Aneurysm.** Five patients with aortic aneurysm were operated on. Three unruptured abdominal aortic aneurysms were excised by Dr. Denton Cooley. In all three, the lesion extended to the renal vessels and a "Y" excision was used. In the first two an aortic homograft was used, and in the third a nylon cloth graft impregnated with a stiffening plastic. The results in these patients were highly gratifying.

In the other two patients, one had a huge abdominal aortic aneurysm which ruptured some hours prior to exploration. In spite of all efforts to cross-clamp the aorta and replace blood loss, the patient continued to exsanguinate and died. The other patient had a thoracic aneurysm. Excision of the aneurysm with homograft replacement was followed by partial paralysis of the lower extremities from ischemia of the spinal cord. This patient died some months later after a stormy course.

TABLE 5. *Cardiovascular operations on 105 patients at Brooke Army Hospital from 1950 to 1954*

| Diagnosis | Number of operations | Operative deaths | | Late deaths | | Total mortality | | Complications | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | Percent | Number | Percent | Number | Percent | | |
| Patent ductus arteriosus | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 phrenic<br>1 recurrent | 17 ligated<br>14 divided |
| Mitral stenosis | 21 | 0 | 0 | 0 | 0 | 0 | 0 | Pure<br>1 SBE<br>1 pleurisy<br>Regurgitation<br>2 recurrent failure<br>1 hydrothorax<br>1 pneumonia | 16 pure stenosis<br><br><br>5 regurgitation |
| Coarctation of aorta | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 1 explore only<br>2 bled mildly | 3 graft<br>7 suture |
| Interatrial septal defect | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 1 vein anomaly<br>1 pericarditis<br>1 SBE<br>1 pleurisy | 4 Bailey<br>2 Crafoord<br>3 Gross |
| Tetralogy of Fallot | 8 | 2 | 25 | 0 | 0 | 2 | 25 | | |
| Pure pulmonary stenosis | 6 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Aortic aneurysm | 4 | 0 | 0 | 1 | 25 | 1 | 25 | | 3 abdominal<br>1 thoracic |

TABLE 5. *Cardiovascular operations on 105 patients at Brooke Army Hospital from 1950 to 1954*—Continued

| Diagnosis | Number of operations | Operative deaths | | Late deaths | | Total mortality | | Complications | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | Percent | Number | Percent | Number | Percent | | |
| Ruptured aortic aneurysm | 1 | 1 | 100 | | | 1 | 100 | | Explored only |
| Coronary artery disease | 2 | 0 | 0 | 0 | 0 | 0 | 0 | | Powdered asbestos<br>Partial ligation<br>Coronary sinus |
| Transposition of great vessels | 2 | 1 | 50 | 1 | 50 | 2 | 100 | | Atrial septal defect plus Blalock anastomosis |
| Aortic insufficiency | 2 | 1 | 50 | 1 | 50 | 2 | 100 | | Hufnagel valve |
| Subaortic stenosis | 2 | 2 | 100 | | | 2 | 100 | | |
| Constrictive pericarditis | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Aortic vascular ring | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Foreign body | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | Battle wound |
| Aortic window | 1 | 1 | 100 | | | 1 | 100 | | |
| Total | 105 | 8 | 7.5 | 3 | 2.8 | 11 | 10.3 | | |

**Coronary Artery Disease.** In two instances, patients with myocardial ischemia due to coronary sclerosis were operated on, and powdered asbestos was placed in the pericardial sac to stimulate adhesions with the hope that increased myocardial vascularity would result. Both of these patients were improved, as evidenced by increased exercise tolerance and decreased anginal pain.

**Transposition of Great Vessels.** Two patients were operated on for this serious disorder; one died shortly after operation, the other some months later. In both cases an interatrial septal defect was created, plus a Blalock-Taussig type of subclavian pulmonary-artery anastomosis, in an effort to induce greater mixing of blood between the pulmonic and systemic circulations.

**Aortic Insufficiency.** Two patients in this category were operated on for insertion of the Hufnagel valve.[14] The first procedure went well; the patient left the hospital, but died suddenly some months later. Autopsy showed a well-healed aorta with functioning valve. No cause for death could be ascertained. The other operation was an error in judgment because the patient was too ill even to sit in a wheelchair. Under refrigeration, an attempt was made to introduce the valve but, as the aorta was cross-clamped, the tremendous heart went into arrest and resuscitation failed.

**Subaortic Stenosis.** Two patients were operated on and were found to have this condition as a part of multiple defects. Both died, no corrective operative procedure having been attempted.

**Constrictive Pericarditis.** In one patient a severe calcified constricting pericardium was excised successfully. This man had a very flabby myocardium and, although he showed improvement after operation, he was not restored to normal. His pericardium was so thick and hard that rib shears were needed to cut it.

**Vascular Ring.** A vascular ring in one patient which surrounded and partially obstructed the esophagus was successfully divided.

**Foreign Body in the Heart.** A metallic fragment in the myocardium of one patient was easily removed. Recovery was complete.

**Pulmonary-Aortic Window.** In one instance, a child was operated on under refrigeration with a tentative diagnosis of patent ductus or aortic window. There was no patent ductus, but a large window at the origin of the aorta was found. Its diameter was greater than the hypoplastic aorta. The dissection was without event but after the clamps had been applied a tear developed into the right pulmonary artery. Although the shunt was quickly divided and sutured and clamps were applied to the area of leak, fatal cardiac arrest developed.

## SUMMARY AND CONCLUSIONS

Close co-operation between those working in cardiology, radiology, and surgery is essential in the workup and therapy of patients with cardiovascular lesions that are amenable to surgical correction.

In the period 1950 to 1954, 105 patients in this category have been operated on at this hospital (table 5) with an operative mortality rate of 7.5 percent, a late mortality rate of 2.8 percent, and a total mortality rate of 10.3 percent, in spite of the fact that no patient has been refused operation because of the seriousness of the risk.

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## TREATMENT OF ULCERATIVE COLITIS

The mortality following surgical treatment of ulcerative colitis will be reduced by a more conservative surgical management, by proper selection of time for operation on the part of both internist and surgeon, and by proper surgical procedures. A point of particular importance is that these patients must be followed regularly for the duration of their life. It must be impressed upon them that they must report any difficulties with the function of the ileostomy, and other abdominal symptoms. It is the responsibility of both the internist and surgeon to maintain an interest in patients with ulcerative colitis, who have been submitted to surgical care, for the remainder of their lives or the patient's life.

— RICHARD B. CATTELL, M. D.
in *American Journal of Surgery*, p. 616, Nov. 1953

# AN ANALYSIS OF PSYCHIATRIC CASE HISTORIES

JAMES L. FRAMO, *Ph. D.*
DUDLEY H. RIFFE, *Lieutenant (MSC) USNR*

IN ORDER to describe the kinds of psychiatric patients admitted to the neuropsychiatric service of this hospital, such questions as Where do these patients come from? What are they like? What happens to them here? and Where do they go? were considered pertinent. A study of such factors not only has unlimited research potentialities, but also should assist Naval Psychiatry in evaluating the effectiveness of its over-all treatment program and disposition policy, and, perhaps, its role in recruit selection. Then, too, the results of such a study should be of interest to the behavioral sciences as a whole (particularly in the area of admission symptomatology).

In evaluating these results for possible comparison with other populations, two factors which tend to operate against each other must be kept in mind. First, it must be remembered that service personnel are a selected population in that all had to meet certain minimum physical, educational, and mental standards in order to be admitted into the armed services. In this sense one might safely postulate that, by and large, service personnel are healthier and better educated than is a random sample of the civilian population. An argument could perhaps be made that the present military population would be found to suffer from different types of mental disorders and differ from the civilian population in other vital respects. Accordingly, one should be cautious about applying generalizations based on the results of this study to the populace at large. Second, this hospital is the treatment center for naval personnel on the East Coast and, as such, the great majority of the patients it gets are the more serious cases which could not be disposed of at the lower treatment centers (*e. g.,* aboard ships or at dispensaries and local naval hospitals). In other words, by the time a patient gets to this hospital he is usually at the last step of the treatment sequence and ready either for discharge or duty. Seriousness of psychiatric illness is the only criterion for admission to this hospital, as there is no established naval policy governing selection of patients on any other basis (*e. g.,* of sex, rank,

From U. S. Naval Hospital, Philadelphia, Pa.

religion, race, et cetera). These two factors do not necessarily cancel each other out; however, they should be considered in evaluating the results.

## METHOD

Out of 1,691 patients discharged from the neuropsychiatric service in 1953, a random sample of 200 case history summaries was selected by taking every eighth case from the files. This method is consistent with standard sampling technic and avoids any systematic biases. Inasmuch as psychiatric cases were the focal point of attention, all neurologic cases were eliminated as well as any on which the records were grossly incomplete. From this sample of 200 cases the following data were abstracted: age, sex, marital status, race, religion, education, rank, branch of service, average length of service, family constellation, disciplinary record, source of admission, length of hospitalization, incoming diagnosis, change of diagnosis if any, final diagnosis, disposition, type of treatment, the symptoms presented by the patient on admission to the sick list, and the symptoms that the patient had while on this service.

In most cases, the median rather than the mean was used as a measure of central tendency (average figure) because of the tendency for the data to be non-normally distributed (*i. e.,* slanted in a particular direction and weighted with extreme scores). Where the median was not used as the average figure, note was made of the fact.

Running comments have been made as the data are presented in order that direct comparisons can be drawn with other populations. The source of information on national averages was obtained from U. S. Census Bureau statistics on the 1950 census as contained in an almanac.[1]

## RESULTS

### *Age*

The average age of patients admitted was found to be 23 years, with a range of 18 to 48. It would appear that this population is, on the whole, younger than are patients admitted to civilian state hospitals. Because of the relationship between mental disorder and age, one would anticipate that the types of psychiatric illness encountered in military life would differ from those found in civilian life. For example, the relatively large proportion of character disorders seen in this hospital is probably largely a function of the youth of the group, as well as, perhaps, the greater opportunity in the military services for these types of disorders to come to the attention of the authorities.

*Sex*

Of the patients admitted, 93 percent were men and 7 percent were women. The Bureau of Naval Personnel[2] reported that as of May 1954 the proportion of men to women in the entire naval service was 98.6 percent to 1.4 percent. Statistically, these differences were found to be highly significant; in other words, our data indicate that women in the naval military service are more likely to incur psychiatric breakdown than are men—proportionate, of course, to their ratio in the entire service. The implications in this finding perhaps bring into focus some questions, the answers to which affect the over-all efficiency of the naval service. For example, does the screening process of women into the Navy need re-examination? In line with this, should not the personality characteristics, the motivations, and expectations of women joining the Navy be more critically evaluated? Could more careful classifications and duty assignments contribute to lowering the high incidence of psychiatric illness in women? Does the factor of lowered prestige of women in the peacetime military services play a part, and can public relations do anything to increase social acceptance? Further investigation of these problems certainly seems warranted.

*Marital status*

Of the patients admitted, 68 percent were single, 27 percent were married, and 5 percent were separated or divorced. The U. S. Census Bureau[1] reports that at the age of 23 (our average admission age) 47 percent of all men in the country in 1950 were single. In our age group, consequently, there tends to be a larger proportion of single men than in the general population. This result appears reasonable and suggests that younger men in the service are postponing marriage.

*Race*

In a distribution of patients by race, 88 percent were Caucasian, 10 percent were Negro, and 2 percent were unclassified (Filipino, Puerto Rican, et cetera). According to the 1950 census,[1] the following is the proportion of races in the United States: 88.4 percent Caucasian, 11.5 percent Negro, and 0.5 percent other. No statistically significant differences were found in the proportion of the two major races in the patient group and the country at large.

*Religion*

The distribution of patients by religion was as follows: 63.5 percent Protestant, 33.0 percent Catholic, and 3.5 percent Jewish. One can roughly compare these figures to those obtained from

the Yearbook of American Churches[3] on the national distribution: 58.8 percent Protestant, 32.8 percent Catholic, 5.4 percent Jewish, and 2.9 percent other.

It should be kept in mind that the figures on the patients are based on their religion as stated on entrance into service. The national distribution is based on church membership. None of the figures gives any indication of the degree of religious adherence. In order to correctly evaluate the data on the patients, it would be necessary to know the distribution of religions throughout the entire naval service so as to determine whether or not a disproportionate number of adherents to one religion suffer breakdown; these data were not available.

*Education*

The average (mean) number of years of education completed was 10.7 years, although the most frequently occurring (mode) level which was reached was 12 years, or high school graduation. The 1950 census[1] reported that the average number of years of education for the population of the United States in that year was 9.3 years. Thus, this patient population appears better educated, on the average, than the general civilian population.

*Rank*

In this group 7 percent were officers, 25 percent were rated enlisted personnel, and 68 percent were nonrated enlisted personnel.

Statistics obtained from the Bureau of Naval Personnel show the following distribution throughout the Navy and Marine Corps as of May 1954: 10 percent officers, and 90 percent enlisted men.

These differences were not found to be statistically significant and could have been due to sampling variations.

*Branch of service*

Of the group 74 percent were in the Navy, 21 percent in the Marine Corps, and 5 percent in the Air Force.

The Bureau of Naval Personnel statistics[2] show the following distribution for the entire naval service: 77 percent Navy and 23 percent Marine Corps.

No statistically significant difference was found in these figures which would indicate that either Navy or Marine Corps personnel are hospitalized for psychiatric reasons in greater proportion than would be expected from their numerical ratio in the service.

*Length of service*

The average length of military service of patients admitted to the Neuropsychiatric Service was 25 months. Of all the patients, 80 percent had less than 4 years' service, whereas Bureau of Naval Personnel statistics show that 65 percent of the entire naval service has less than 4 years' service. This difference was not found to be statistically significant, indicating that the reason the great majority of the patients are those with short service (less than 4 years) is simply due to the fact that the Navy is largely composed of short-service personnel. Contrary to expectation, those persons who have been in the naval service more than 4 years are proportionately just as likely to become psychiatric casualties as those who have been in a short time.

*Family constellation*

Many investigators have stressed that one of the causative factors in mental illness is faulty identification as a result of the loss of one or both parents at a crucial age. This section provides some data on this point.

At the time of their admission to the sick list, 49 percent of our patient population had parents living together. Accordingly, about half of all the patients (51 percent) came from homes which were broken for one reason or another. Statistics on the national average of broken homes were not available, but it is reasonable to assume that these patient figures are higher. Whether broken homes are a factor in the development of mental illness cannot, of course, be answered conclusively by this data. It appears to be symptomatic of all forms of social disorganization (*e. g.*, delinquency and crime as well as mental illness). It is interesting to note that of the 49 percent who had parents living together, note was made in the records of 18 percent of considerable parental dissension.

At an early age, 15 percent of the patients lost their fathers and 10 percent lost their mothers through death. At an early age, 20 percent of the patients were separated from their fathers through legal separation or divorce. Two percent were separated from the father for other reasons (*e. g.*, desertion, commitment to a mental institution, et cetera). At an early age, 6 percent of the patients were separated from their mothers through legal separation or divorce. Four percent were separated from their mothers for other reasons (*e. g.*, commitment to a mental institution, desertion, illegitimacy).

Up to and including the age of 12, 9 percent of the patients were reared by the mother alone and less than 1 percent by the

father alone; 1 percent were reared by a father and stepmother, 5 percent by a mother and stepfather, and 16 percent by other combinations (largely shifting parental figures). An interesting sidelight of this data is that, up to and including the age of 12, 13 percent of the patients were reared by women alone and less than 1 percent by men alone, of whatever combination. Consequently, this seems to lend support to previous evidence that there is, in our culture, greater opportunity for feminine identification than for masculine identification.

Twenty-two percent of the patients were the oldest child, 27 percent were the youngest child, 37 percent were in the middle, and 14 percent were only children.

Previous investigators have propounded many theories around the relationship between psychopathologic conditions and ordinal position in the family. The statistics on the national average of people who were the eldest, youngest, and only children were not taken by the Census Bureau, so there is no way of knowing how these figures compare. With reference to the category of "only children," there are some workers in the field who maintain that being an "only" child makes one more susceptible to mental illness (because of such factors as overprotection, inadequate learning of social skills, et cetera). Others maintain, however, that the problems of sibling rivalry are more difficult for children to cope with than are the problems which "only" children, unencumbered by sibling jealousies, have to face. The data presented here does not suggest that an undue number of "only" children were admitted.

*Disciplinary record*

Of the patients admitted to this hospital, 26.5 percent had disciplinary charges in their record (*i. e.*, mention was made in the case history either of a violation occurring in the past or of one on which charges were pending).

*Source of admission*

Following are the immediate sources from which all of the psychiatric patients were admitted to the neuropsychiatric service.

Of the group, 72.5 percent were transferred from another hospital, the most frequent source of our admissions. Of the remaining patients, 17 percent were transferred directly from dispensaries; 5.5 percent were admitted directly to this hospital (*e. g.*, hospital staff personnel and those brought in by military police from liberty); 2 percent were transferred directly from a ship; 1 percent were transferred from the brig; 0.5 percent were transferred directly from overseas hospital; 0.5 percent were

transferred from other hospitals to the medical service of this hospital before coming on the neuropsychiatric service; 0.5 percent were transferred from a dispensary to the medical service of this hospital before coming on the neuropsychiatric service; and 0.5 percent were transferred from a ship to a dispensary and then to this service.

Breaking down the data in another and perhaps more meaningful way are the following categories: Thirty-eight percent of the patients became ill while on shipboard duty. It is impossible to state precisely what proportion of these patients were on overseas shipboard duty and what proportion were on stateside shipboard duty, although the latter were in the great majority. At least 16.5 percent of the patients admitted to this service originally broke down overseas. Of these, 9.5 percent were on overseas shore duty and about 7 percent were on overseas shipboard duty. (This 7 percent may be somewhat higher because we cannot determine whether any of the patients admitted from stateside ships became ill while the ships were returning from overseas.) Five percent of the patients were admitted from the brig. This figure is larger than the brig figure reported previously because the majority of these patients stopped at other installations on their way to this hospital.

*Disposition*

Of the patients, 39 percent were discharged to their homes; 32 percent were discharged to a Veterans Administration hospital; 14 percent were sent back to duty (12 percent to full duty and 2 percent to limited duty); 4.5 percent were sent back to duty for completion of disciplinary action; and 7.5 percent were returned to the marine barracks. (Of this last group, 3.5 percent were returned for discharge, 3 percent for orders and earned leave, 0.5 percent to await return to duty, and 0.5 percent for limited duty with discharge recommended.) All of the Air Force personnel (2 percent of the patient population) were returned to Air Force jurisdiction with a recommendation for discharge. (*Note:* The Navy does not make final disposition of Air Force personnel and can only recommend disposition.)

*Treatment*

The treatment given patients on this service could only be grouped in rough fashion. For example, psychotherapy could include not only systematic and intensive psychotherapeutic interviews on a regular basis, but more casual contacts as well. Because of the ambiguity of the term and the lack of systematic information in the records, there is no breakdown of this category. This should not be interpreted to mean that psychotherapy was not practiced; on the contrary, there was some evidence

to indicate that quite a bit was going on. In the following categories, the treatment the patient received both prior to admission to this service and while on this service is noted. Of the patient population, 15.5 percent received electroconvulsive therapy; 2.5 percent, prior to coming here and 13 percent, here. Six percent of the patients received insulin shock therapy; less than 1 percent, prior to coming here and 5.5 percent, here. Eighty percent of the patients received nonspecific treatment.

*Length of hospitalization*

The average length of hospitalization for all patients on this service was 61 days. Patients on the average spent 17 days at another installation immediately prior to admission here. Consequently, the total length of hospitalization for the average patient was 84 days.

*Diagnoses*

Incoming and outgoing diagnoses in the major psychiatric categories are shown in table 1.

a. Psychotic disorders

TABLE 1. *Incoming and outgoing diagnoses in the major psychiatric categories*

| Diagnostic categories | Incoming diagnoses (percent) | Outgoing diagnoses (percent) |
|---|---|---|
| Psychotic | 60.0 | 46.0 |
| Psychoneurotic | 16.5 | 13.5 |
| Character disorders | 9.0 | 36.5 |
| Other | 14.5 | 4.0 |

Of all patients admitted with a psychotic diagnosis, the following dispositions were made: 72.0 percent retained a psychotic diagnosis; in 21.5 percent the diagnosis was changed to that of character disorder; in 5.7 percent to psychoneurosis; and in 0.8 percent to psychiatric observation.

The changes in diagnosis among psychotic disorders are noted in table 2.

b. Psychoneurotic disorders

Of all patients admitted with a psychoneurotic diagnosis, the following dispositions were made; 37.0 percent retained a psychoneurotic diagnosis; in 57.0 percent the diagnosis was changed to that of character disorder; and in 6.0 percent to a psychosis.

The changes in diagnosis among psychoneurotic disorders are noted in table 3.

c. Character and behavior disorders

Of all patients admitted with a character and behavior disorder diagnosis, the following dispositions were made: 76.0 percent retained a character and behavior disorder diagnosis; in 12.0 percent the diagnosis was changed to that of psychiatric observation; in 6.0 percent to a psychosis; and in 6.0 percent to a psychoneurosis diagnosis.

TABLE 2. *Incoming and outgoing psychotic diagnoses*

| Psychotic disorders | Incoming diagnoses (percent) | Outgoing diagnoses (percent) |
|---|---|---|
| (Schizophrenia, all types) | (55.0) | (43.5) |
| Schizophrenia, paranoid type | 26.0 | 22.0 |
| Schizophrenia, n. e. c.* | 14.0 | 12.0 |
| Schizophrenia, catatonic type | 6.0 | 4.0 |
| Schizophrenia, simple type | 5.0 | 4.0 |
| Psychotic depressive reaction | 4.0 | 1.5 |
| Schizophrenia, latent type | 2.0 | 1.5 |
| Schizophrenia, hebephrenic type | 1.5 | - |
| Manic depressive reaction | 1.0 | 0.5 |
| Paranoid state | 0.5 | 0.5 |

*Not elsewhere classified.

TABLE 3. *Incoming and outgoing psychoneurotic diagnoses*

| Psychoneurotic diagnoses | Incoming diagnoses (percent) | Outgoing diagnoses (percent) |
|---|---|---|
| Anxiety reaction | 5.5 | 4.5 |
| Neurotic depressive reaction | 5.0 | 3.5 |
| Conversion reaction | 2.5 | 2.0 |
| Dissociative reaction | 1.0 | 0.5 |
| Psychogenic musculoskeletal reaction | 1.0 | 1.5 |
| Obsessive-compulsive reaction | 0.5 | 1.5 |
| Psychogenic skin reaction | 0.5 | - |
| Phobic reaction | 0.5 | - |

The changes in diagnosis among character and behavior disorders are noted in table 4.

Although only 9.0 percent of all patients were admitted with character and behavior disorder diagnoses, 36.5 percent were discharged with that type of diagnosis. One possible explanation for this finding is that some of these patients essentially re-

covered from a brief, acute psychotic breakdown and exhibited the basically defective character which predisposed them to react to stress with psychopathologic symptoms (so-called "3-day schizophrenia"). Another possible explanation is that these patients were misdiagnosed as psychotic at previous installations because of an insufficient period of observation and the exigencies of the examining situation.

TABLE 4. *Incoming and outgoing character and behavior disorders*

| Character and behavior disorders | Incoming diagnoses (percent) | Outgoing diagnoses (percent) |
|---|---|---|
| Emotional instability reaction | 2.0 | 9.0 |
| Passive-aggressive reaction | 1.5 | 3.0 |
| Schizoid personality | 1.5 | 4.5 |
| Passive dependency reaction | 1.0 | 8.0 |
| Addiction | 1.0 | 0.5 |
| Paranoid personality | 0.5 | 1.0 |
| Immaturity with symptomatic habit reaction | 0.5 | - |
| Inadequate personality | 0.5 | 6.0 |
| Alcoholism | 0.5 | - |
| Antisocial personality | - | 1.5 |
| Aggressive reaction | - | 1.5 |
| Cyclothymic personality | - | 0.5 |
| Specific learning defect | - | 0.5 |
| Acute situational maladjustment | - | 0.5 |

d. Other

Of all patients, 14.5 percent were admitted with diagnoses other than psychiatric. They are classified as follows: 7.0 percent were admitted for psychiatric observation; 6.5 percent were admitted with miscellaneous diagnoses (primarily physical disorders); and 1.0 percent were admitted with diagnosis undetermined without a tentative diagnosis. Four percent of all patients were discharged as follows: 2.0 percent for psychiatric observation; 1.5 percent for miscellaneous reasons (usually physical disorders); and 0.5 percent for medical or surgical observation.

*Symptoms*

Table 5 presents a fairly exhaustive inventory of the symptoms that patients tend to have when they are hospitalized for psychiatric reasons. The figures in the columns refer to the percentage of patients who had any particular symptom; obviously, each patient had more than one symptom. A comparison is made between the frequency of symptoms on admission to the sick list and on admission to this hospital.

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TABLE 5. *Percentage and order of frequency of symptoms as presented upon initial admission to the sick list and as noted at this hospital**

| Symptoms | Noted previously | | Noted here | |
|---|---|---|---|---|
| | Order | Percent | Percent | Order |
| Suspiciousness, feels influenced, paranoid ideas, ideas of reference | 1 | 33.0 | 29.0 | 3 |
| Hallucinations | 2 | 24.0 | 19.5 | 6 |
| Flat or inappropriate affect | 3 | 23.0 | 29.0 | 2 |
| Perplexed, confused, mixed up | 4 | 22.5 | 15.5 | 7 |
| Tense, nervous, anxious, worried, fearful | 5 | 22.0 | 30.0 | 1 |
| Withdrawn, isolated, no friends | 6 | 20.0 | 22.5 | 4 |
| Depressed, despondent | 7 | 15.5 | 22.5 | 5 |
| Delusions | 8 | 15.0 | 9.0 | 13 |
| Bodily complaints (hypochondriacal, gastrointestinal symptoms, nervous stomach, feels diseased, somatic delusions, feels somatic changes) | 9 | 15.0 | 14.0 | 8 |
| Bizarre ideas | 10 | 14.0 | 10.0 | 10 |
| Disorganized, tangential, incoherent | 11 | 10.0 | 9.0 | 11 |
| Suicidal attempt | 12 | 9.5 | 2.0 | 32 |
| Headaches | 13 | 9.0 | 5.5 | 16 |
| Drinking | 14 | 8.0 | 2.5 | 26 |
| Religious preoccupation | 15 | 8.0 | 6.0 | 15 |
| Self-deprecatory ideas | 16 | 7.5 | 8.5 | 14 |
| Emotional outbursts, temper outbursts | 17 | 7.0 | 1.5 | 35 |
| Hyperactivity | 18 | 6.5 | 3.0 | 24 |
| Inept, inadaptable | 19 | 6.5 | 12.0 | 9 |
| Suicidal ideas | 20 | 6.0 | 3.5 | 22 |
| Threatens assault | 21 | 6.0 | 2.5 | 27 |
| Assaultive | 22 | 5.5 | 5.0 | 17 |
| Sexual preoccupation | 23 | 5.0 | 2.5 | 28 |
| Insomnia | 24 | 5.0 | 4.5 | 18 |
| Feels perverted, troubled by ideas of homosexuality | 25 | 4.0 | 2.0 | 33 |
| Blackouts, fainting spells | 26 | 4.0 | 0.5 | 41 |
| Psychosomatic disorders (*e. g.*, asthma, hypertension, ulcer, allergy, neurodermatitis) | 27 | 3.5 | 3.5 | 21 |
| Disturbed, excited, destructive, maniacal-like outbursts | 28 | 3.5 | 0.5 | 42 |
| Euphoric, hypomanic, elated | 29 | 3.5 | 4.5 | 19 |
| Apathetic, listless, no energy, easily fatigued | 30 | 3.5 | 9.0 | 12 |
| Does not eat (anorexia) | 31 | 3.5 | 1.0 | 38 |
| Verbalized fear of own hostile impulses | 32 | 3.5 | 1.0 | 39 |
| Stuttering | 33 | 3.5 | 2.5 | 30 |
| Feelings of sexual inadequacy | 34 | 3.0 | 2.5 | 29 |
| Mood swings | 35 | 3.0 | 1.5 | 36 |
| Depersonalization, feelings of unreality | 36 | 2.5 | 2.0 | 34 |
| Helplessness, indecision, clinging | 37 | 2.5 | 3.0 | 25 |
| Obsessions | 38 | 2.5 | 3.5 | 23 |
| Compulsions | 39 | 2.5 | 1.5 | 37 |
| Robbery, larceny, breaking and entering | 40 | 2.5 | - | - |

TABLE 5. *Percentage and order of frequency of symptoms as presented upon initial admission to the sick list and as noted at this hospital**—Continued

| Symptoms | Noted previously | | Noted here | |
|---|---|---|---|---|
| | Order | Percent | Percent | Order |
| Irritable, hostile | 41 | 2.0 | 2.5 | 31 |
| Amnesia | 42 | 2.0 | 0.5 | 43 |
| Phobias | 43 | 1.5 | 0.5 | 44 |
| Passive obstruction, pouting, stubbornness | 44 | 1.5 | 4.0 | 20 |
| Flight of ideas | 45 | 1.0 | - | - |
| Narcotic addiction | 46 | 1.0 | 0.5 | 45 |
| Homosexuality (acting out) | 47 | 1.0 | 0.5 | 46 |
| Feels going crazy | 48 | 0.5 | - | - |
| Overeats | 49 | 0.5 | - | - |
| Tics | 50 | 0.5 | 1.0 | 40 |
| Lying | 51 | 0.5 | - | - |
| Accused of rape, incest, seduction | 52 | 0.5 | 0.5 | 47 |
| Fire setting | 53 | 0.5 | - | - |
| Mutism | 54 | 0.5 | 0.5 | 48 |
| Enuresis | 55 | 0.5 | 0.5 | 49 |
| Waxy flexibility | 56 | 0.5 | - | - |

*This list was based on a list compiled by the Psychology Department of the Worcester State Hospital through the courtesy of Dr. Leslie Phillips, Chief Psychologist.

## SUMMARY

In this study an analysis was made of the characteristics of patients who passed through the neuropsychiatric service of a large naval hospital. A random sample of 200 case history summaries was selected from among 1,691 patients discharged in 1953, and the following data were collected: age; sex; marital status; race; religion; education; rank; branch of service; average length of service; family constellation; disciplinary record; source of admission; length of hospitalization; incoming diagnosis, change of diagnosis, and final diagnosis; disposition; type of treatment; admitting symptoms; and symptoms while on this service. Using certain relevant factors as criteria, comparisons were made between this military patient population and the civilian population of the country as a whole.

## CONCLUSIONS

A study such as this, it seems to us, should be the precursor of any planned research program using human subjects in large numbers. Until the researcher knows the kind of population with which he is dealing he will be unable to plan a research program intelligently.

Collection of a series of actuarial studies like this one throughout all psychiatric installations of the military services should

bring into closer focus the characteristics of service personnel who incur psychiatric breakdown. (For example, our finding that women in the naval military service incur psychiatric breakdown significantly more often than is proportionate to their numbers in the service leads to a potentially fruitful area of investigation.) Knowledge of these characteristics and their refinement through further research should be of assistance to those who deal with the problem of psychiatric screening. Prediction of behavior is the weakest of all the functions of the behavioral sciences, but more accurate information on the characteristics of psychiatric casualties might help in initially eliminating those who are likely to break down later.

The main function of this hospital, of course, is treatment and care of the psychiatrically ill so that they can either return to duty or be returned to civilian life in the best possible state of health. This research should be of assistance to psychiatric services of all military hospitals, not only in planning future treatment programs but also in the selection of treatment personnel, in organizing the physical plant, and in other administrative decisions.

Consideration of the more theoretic implications of some of our results is perhaps in order. A possibly significant sociocultural trend is reflected in the finding that a large preponderance of patients who are not psychotic are discharged from this major neuropsychiatric center with character and behavior disorders. In most cases, the psychotic patients also are found to have prominent pathologic character traits. While it is a truism that everyone has a character, patently all people do not have lifelong adjustment difficulties with society. Our data, however, suggest that these character defects, these basic personality maldevelopments, are more prevalent than had been heretofore believed. Admittedly, there are certain practical dispositional reasons which in some cases lead naval psychiatrists to establish these diagnoses, and in many civilian clinics the neurotic features may be emphasized in establishing diagnoses; the question seems to revolve about the nosologic issue of diagnosing on the basis of symptoms, dynamics, or development. Despite the fact that psychiatric textbooks devote relatively little space to these problems and expand at length on the neuroses, the facts of the matter are, insofar as this installation is concerned, that neurotic illness in pure culture is exceedingly rare. Indeed, we wonder how many true neurotics of the ideally analyzable type, uncontaminated by defects of character, are actually seen in any private practice or outpatient clinic. There are more questions raised than answered by this finding—*viz.*, are the disorders of character in our society more pervasive than they used to be? Are we simply becoming more aware of the character and

behavior disorder? Are we belatedly recognizing that the superficial symptom picture is of relatively minor importance in, say, determining the outcome of the illness? In relation to this latter question, for example, anxiety, the most frequent symptom on admission to this hospital, is exhibited or expressed by patients of all degrees and kinds of psychiatric illness, and is frequently used as a gauge of prognosis; the more elusive concept of maturity, on the other hand, may be of more crucial prognostic relevance. Part of the difficulty with this whole question is that a character disorder may have protean manifestations ranging from clinging dependency through social inadequacy to drug addiction or assaultive acting out.

The answers to these questions, of course, can only be provided by future research. The most potentially fruitful area of study, it would seem, would be isolation from the early developmental years of the variables that predispose one person toward a psychosis, another toward a neurosis, another toward a disorder of character or behavior, and another toward "normality."

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ACKNOWLEDGMENT. We are indebted to Captain John F. McMullin, Chief of Neuropsychiatry, U. S. Naval Hospital, Philadelphia, Pa., for having provided the original idea and impetus for this study.

## "THE MAD ENGLISHMAN"

There were many unimportant aspects of American Army hospital life that were strange to me, the visiting Englishman. I was never able to comprehend, nor could anyone inform me, why it was that, winter and summer, all windows were half covered with blinds to exclude the sun and the light, while all the artificial lighting blazed. I made occasional attempts to let in the light and the air, but soon had to desist. My American friends pulled my leg about it. I was the mad Englishman who enjoyed fresh air and playing games and walking for pleasure.

—KEMBLE GREENWOOD, Maj., RAMC
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# PORTAL VENOGRAPHY

ROBERT L. RUDOLPH, *Major, USAF (MC)*

ATTENTION has been focused on vasography in the evaluation of diseases of the liver and spleen in the past 10 years, due chiefly to the advances in vascular surgery in the treatment of portal hypertension. Radiopaque media are injected into the portal circulation by various routes for roentgenographic visualization. These injections have been made into the superior mesenteric vein,[1] splenic vein,[2,3] right gastroepiploic vein,[4] and a branch of the coronary vein.[5] The sequelae of these procedures are minimal; however, Walker and associates[6] reported a case in which splenic injection of diodone (brand of diethanolamine salt of 3,5-diiodo-4-pyridone-N-acetic acid) at laparatomy resulted in a delayed hemorrhage requiring reoperation and splenectomy. A number of reports have appeared in recent years describing portal venography by different technics.[7-11]

In 1951, Leger and associates[12] working in Paris produced one of the first portal venograms by percutaneous splenic injection.* This work, along with that of Abeatici and Campi,[15] who injected joduron (an organic iodine contrast medium) into the spleens of dogs, stimulated widespread interest in the procedure, and subsequently several reports on the subject have appeared in the English literature.

Percutaneous splenic portal venography was performed on 15 patients with a variety of clinical entities; operative portal venograms were made of 4 additional patients. Some of these experiences will be considered in detail.

## ANATOMY

A precise understanding of the anatomy of the extrahepatic portal circulation is necessary for the proper evaluation of portal venograms. The arrangement most commonly found by Douglass and associates[16] in their study of 92 autopsy specimens is reproduced in figure 1.

From City Hospital of Akron, Akron Ohio. Maj. Rudolph is now assigned to U. S. Air Force Hospital, Selfridge Air Force Base, Mich.

*Splenic puncture, as such, was not a new procedure. Vidal probably did the first splenic puncture late in the nineteenth century for the diagnosis of typhoid fever. The procedure was adopted widely in Europe and Asia for the diagnosis of tropical parasitic infections and Gaucher's disease. There have been only sporadic reports of its use in the United States.[13,14]

Another anatomic factor to be recalled is the natural communications existing between the portal and caval venous systems. Under normal conditions these inosculations seldom function and each system is physiologically separate. These communications are of great importance in certain pathologic conditions, which result in hypertension in either the portal or caval system. The direction of the venous blood may reverse with flow from one system to the other, with subsequent dilatation of the communication as exemplified in the Cruveilhier-Baumgarten syndrome.

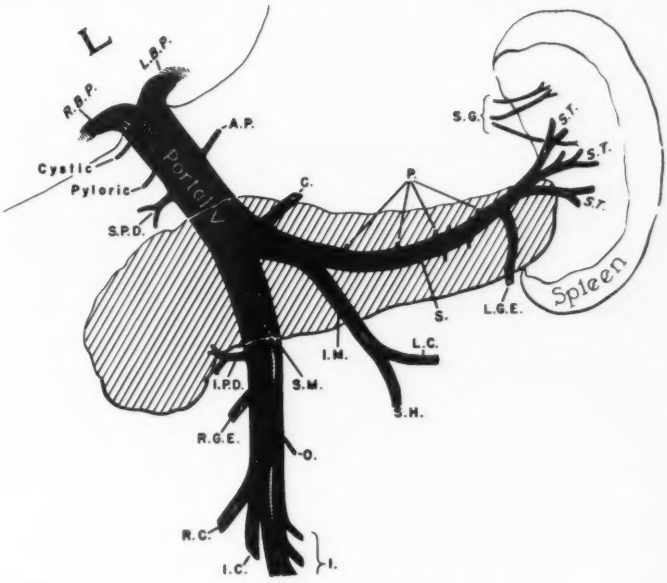


Figure 1. The extrahepatic portal system of veins, anterior aspect.

A. P. = accessory pancreatic v.
C. = coronary vein
Cystic = cystic vein
I. = intestinal veins
I. C. = ileocolic vein
I. M. = inferior mesenteric v.
I. P. D. = inferior pancreaticoduodenal vein
L. = liver
L. B. P. = left branch of portal vein
L. C. = left colic vein
L. G. E. = left gastroepiploic v.
O. = omental vein
P. = pancreatic veins
Pyloric = pyloric vein
R. B. P. = right branch of portal vein
R. C. = right colic vein
R. G. E. = right gastroepiploic vein
S. = splenic vein
S. G. = short gastric veins
S. H. = superior hemorrhoidal v.
S. M. = superior mesenteric vein
S. P. D. = superior pancreaticoduodenal vein
S. T. = splenic trunks

(Reproduced with permission from: Douglass, B. E.; Baggenstoss, A. H.; and Hollinshead, W. H.: Variations in portal system of veins. *Proc. Staff Meet., Mayo Clin.* 25: 26-31, Jan. 18, 1950.)

## PHYSIOLOGIC CONSIDERATIONS

Some interesting observations are made by portal venography concerning portal and splenic physiology. The theory of bilaterality of, or "streamline" portal blood flow was advocated by Copher and Dick,[17] and Hahn and associates[18] who postulated that blood from the spleen, stomach, and greater part of the colon goes to the left lobe of the liver whereas blood from the duodenum, head of the pancreas, and small intestine is returned to the right lobe of the liver. This is not substantiated by the roentgenographic findings following portal venography by splenic injection. On the contrary, there is more complete filling of the right branch of the portal vein after splenic injection (fig. 2).

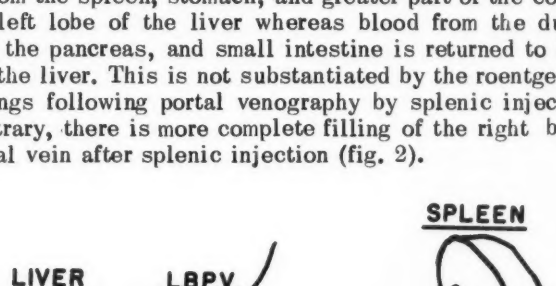


Figure 2. Distribution of the splenic venous return as found by portal venography by percutaneous splenic injection of the contrast media.

I. M. V. = inferior mesenteric vein
L. B. P. V. = left branch of portal vein
P. V. = portal vein
R. B. P. V. = Right branch of portal vein
S. M. V. = superior mesenteric vein
S. V. = splenic vein

The almost instantaneous emptying of the injected media from the spleen lends strong support to MacKenzie and co-worker's[19] conception of an "open" splenic circulation. The contraction of the spleen from the stimulation of the needle puncture may also be a factor in the rapid emptying. The exact manner of connection of the arterioles and venules, however, remains vague.

## TECHNIC OF PERCUTANEOUS SPLENIC PORTAL VENOGRAPHY

The procedure used in this series for splenic puncture and portal venography is simple. A complete blood cell count; bleeding

time, clotting time, and prothrombin time determinations; and a skin sensitivity test to the opaque media are done. If the use of general anesthesia is contemplated, the patient is fasted and treated preoperatively with morphine and atropine. If local anesthesia is to be used, the patient receives 180 mg. (3 grains) of pentobarbital sodium 1 hour before the procedure to counteract any reactions to the procaine hydrochloride and to alleviate apprehension.

The patient is placed in a supine position on a radiographic table with sandbags under the left hip and shoulder to give the body an angle of 15 to 20 degrees. A preliminary roentgenogram of the abdomen is taken to test the roentgenographic technic and, when possible, to locate the splenic shadow. The skin is washed with pHisoderm and painted with aqueous zephiran (brand of benzalkonium chloride). Aseptic precautions are taken throughout the procedure. The splenic puncture is accomplished using a 3-inch, 18-gauge spinal needle introduced in the ninth left interspace at the level of the posterior axillary line. Inserting the needle into the spleen at the end of inspiration avoids the hazard of the sudden reflex descent of the diaphragm when the needle penetrates the peritoneum, the so-called von Nagy reflex.[20] A characteristic rubbery type of resistance is encountered as the needle enters the spleen. Blood can usually be aspirated without difficulty. It has been impossible to control respirations satisfactorily for the necessary period of time except when general anesthesia is used. With local anesthesia, the patient is instructed to breathe as quietly as possible and avoid coughing. Extreme care is exercised not to traumatize the spleen during the excursions.

Ten to 20 ml. of either 35 percent or 70 percent urokon (brand of sodium acetrizoate) or diodrast (brand of iodopyracet) is introduced within 3 seconds, and a roentgenogram taken at the completion of the injection. Following the injection, the needle is quickly withdrawn and the patient returned to his room, where careful observations are made for hemorrhage. The patient remains flat in bed for at least 6 hours.

## INDICATIONS

Although the full potentialities of portal venography have not yet been exploited, the procedure will undoubtedly continue to be used for the preoperative evaluation of patients with clinical portal hypertension by differentiating intrahepatic and extrahepatic blocks of the portal circulation. It will give the surgeon insight as to the status of the great veins of the portal system and will enable him to better plan his surgical procedure preoperatively. The patency of a previous portacaval anastomosis can be conclusively demonstrated. Portal phlebography may aid in the evalu-

ation of the operability of patients with pancreatic and retroperitoneal lesions. Demonstration of metastatic invasion of the splenic or portal vein would preclude any extensive operation. Portal venography may be of value for outlining intrahepatic masses. The measure should be considered for use in the diagnosis of splenomegaly of uncertain origin. At the time of the puncture, a splenic specimen may be taken for histologic study.

## CONTRAINDICATIONS

There are no reported series of portal venograms sufficiently large to clearly delineate the contraindications. The following, however, have been adopted and undoubtedly will be modified by future experience: (1) Severe bleeding tendency; (2) where rapport and complete patient co-operation cannot be expected; (3) where the spleen is prone to rupture as in infectious mononucleosis, recent septic splenomegaly, a tender painful spleen compatible with infarction, or a spleen which has suddenly and rapidly increased in size; and (4) sensitivity to the contrast media.

## COMPLICATIONS AND MORTALITY

The complications of portal venography have been few; however, most of the reported series are small. Hemorrhage remains an ever-present hazard. Walker and associates reported one case of delayed hemorrhage from the spleen necessitating splenectomy after the intrasplenic injection of diodone in the course of a laparotomy 3 days previously. I have a fatality to report in my series. This will be reviewed in detail elsewhere in this article. Some insight as to the expected mortality may be gained from the statistical reports of splenic puncture. Pittaluga[21] reported 2,000 splenic punctures with a 0.3 percent mortality. Block and Jacobson[13] recorded a series of 55 splenic punctures with two fatalities and three additional instances of intra-abdominal hemorrhage.

Pneumothorax is a possible complication because in many technics the pleural cavity is traversed; none have thus far been reported. Infection in the form of empyema or peritonitis has not been a problem to date.

Thus, portal venography by percutaneous splenic injection of contrast media must be considered a calculated risk with potential dangers. All precautions must be taken to prevent possible unfavorable reactions.

## VENOGRAPHY IN TRAUMATIC CASES

Four patients chosen for portal venography studies presented a history of trauma to the upper abdomen with possible splenic injury. It was believed that portal venography might demonstrate an extravasation of the radiopaque media from a rent in the spleen

and also that venograms of normal portal venous circulations should be obtained to serve as a standard for the interpretation of future abnormal venograms.

Case 1. A 31-year-old white man entered the emergency room complaining of pain in the left side of his abdomen and left shoulder. One week previously he had been struck in the left side of the abdomen by a batted ball. For the past week he had continued to work at a trucking company but during this time he had been aware of left upper abdominal soreness. On the day of admission he experienced a sudden, severe left upper abdominal pain which radiated into the left flank and shoulder.

Examination showed a tender left upper abdominal mass, together with point and rebound tenderness present over the entire left side of the abdomen. There was no anemia.

A portal venogram was made, employing the standard technic and 1 percent procaine hydrochloride for local anesthesia; 20 ml. of 35 percent diodrast was injected into the spleen (fig. 3). No adverse effects were noted. The patient was immediately moved to the operating room where a splenectomy was performed through a left subcostal incision. There was about 1,000 ml. of blood in the peritoneal cavity. The postoperative course was uneventful and the patient was permitted to leave the hospital on the eighth day.

In performing the portal venography, a test dose of 5 ml. of diodrast was injected to determine the position of the needle. An excretory urogram of a horseshoe kidney appeared in the final venogram as an incidental finding. This was subsequently verified by intravenous pyelography. The patient denied any urinary symptoms.

The laceration of the spleen was a 3-cm. subcapsular tear on the convex surface, with evidence of both old and new hemorrhage. The site of the splenic puncture could not be demonstrated. The venogram was of no value in substantiating the diagnosis in this one case of delayed rupture of the spleen.

Three additional patients studied had varying severity of trauma to the left upper quadrant of the abdomen. These portal venograms were normal, but served as criteria for interpretation of subsequent venograms. In no instance was the procedure considered to be of any value in making the diagnosis of splenic injury. There were no complications or sequelae. One of the venograms is reproduced in figure 4.

## VENOGRAPHY IN NEOPLASTIC CASES

Two patients were studied by portal venography for possible tumor invasion of the portal venous system or liver proper. In neither case could any tumor invasion or growth be demonstrated, although one patient (case 2) had a huge nodular liver and a known carcinoma of the ovary with disseminated metastases. It is

interesting to speculate as to the place this procedure might fill in the diagnosis of tumors in the body and head of the pancreas.

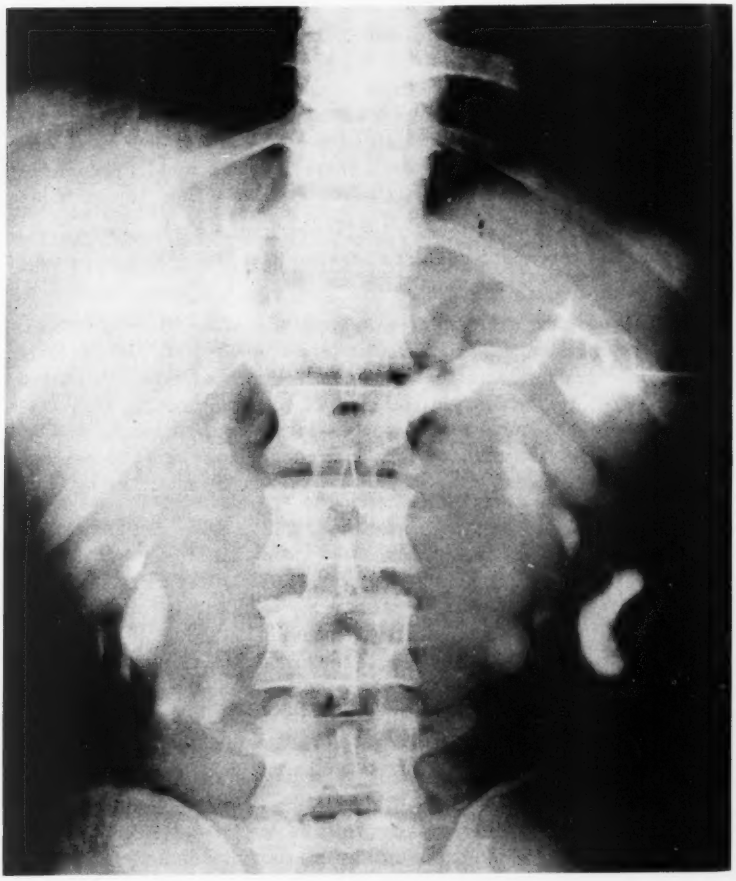

*Figure 3 (case 1). Normal portal venogram. There was no extravasation of diodrast from the rent in the splenic capsule. A pool of diodrast in the left flank from the preliminary injection proved to be outside of the spleen. The needle was reinserted for the final injection. The coincidental finding of a horseshoe kidney is noted.*

Case 2. A chronically ill 35-year-old Negro woman was referred because of "water on the stomach." In 1947 she developed abdominal swelling and subsequently had an operation elsewhere for the removal of an ovarian tumor. The swelling recurred and in October 1950 a second laparotomy was performed in Mississippi. She remained asymptomatic until one year ago when the same trouble recurred, becoming progressively worse.

The abdomen was extremely distended, and obvious flank and shifting dullness and a definite fluid wave were present. Pelvic and rectal examinations revealed a large, hard, fixed pelvic mass.

*Figure 4. Portal venogram of a 17-year-old woman who received a contusion injury to the left upper abdomen followed by a persistent spasm over the splenic area. After injection of 20 ml. of 35 percent urokon, the portal venogram was normal. The right branch of the portal vein was visualized much clearer than the left. Both renal pelves are outlined by urokon previously injected to verify the placement of the needle.*

Paracentesis yielded 8 liters of a cloudy serous fluid which was sent to the laboratory for study for malignant cells. The pathologic report was "metastatic adenocarcinoma of the peritoneum." At the con-

clusion of the paracentesis, a nodular liver and a fixed pelvic mass could be easily palpated.

Portal venography was performed using intravenous pentothal (brand of thiopental sodium) anesthesia. The standard technic was employed for the splenic puncture and 18 ml. of 35 percent urokon injected. It was thought that this might demonstrate obstruction or invasion of the portal venous system (fig. 5).

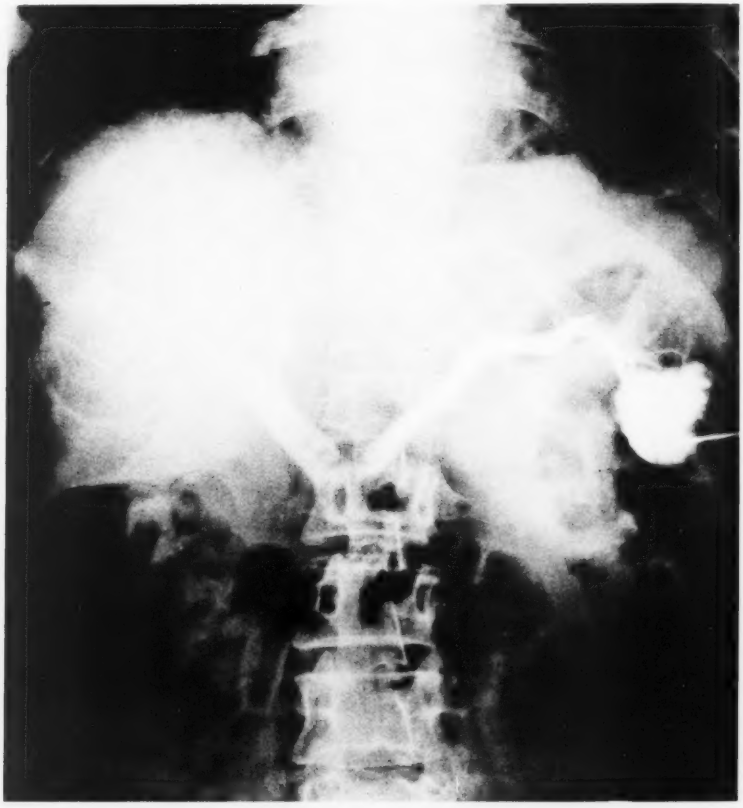

*Figure 5 (case 2). Normal portal venogram. The left branch of the portal vein is visualized much clearer than usual. No obstruction or invasion of the portal venous system is noted. There is no abnormality of the intrahepatic portal circulation that can be attributed to metastatic nodules, although the patient had obvious, large nodular masses in the liver by clinical palpation.*

The patient had an uneventful postvenography course and was released from the hospital on the eighth hospital day with instructions to return for roentgen therapy.

Case 3. A 76-year-old man entered the hospital complaining of progressive enlargement of the abdomen and moderate anorexia of 5 weeks' duration. For 3 weeks prior to admission he had suffered from lower abdominal cramping pain and constipation. There had been a 35-pound loss from his usual weight. Systemic review revealed a severe, chronic, nonproductive cough for 1 year which had improved in the prior 2 months. Hemoptysis was denied.

The patient was an undernourished, elderly white man with poor skin turgor. There were moist rales in both lung bases. The heart was irregular in rate and rhythm due to frequent extrasystoles. A harsh systolic murmur was heard over the entire precordium, being maximal at the aortic area. The abdomen was moderately distended and there was a shifting dullness found on percussion. The liver was palpable 5 cm. below the right costal margin. The findings of laboratory studies were within normal limits. Cardiac enlargement and mild congestive changes were noted on the roentgenogram of the chest. Gastrointestinal and small and large bowel roentgenograms were within normal limits.

Portal venography was done in the standard fashion, using 1 percent procaine locally and pentothal anesthesia intravenously; 20 ml. of 35 percent diodrast was used for the splenic injection (fig. 6).

An exploratory laparotomy was performed 5 days later. The peritoneal surfaces were found to be studded with firm nodules measuring 1 to 2 cm. in diameter. Biopsy specimens from the liver, omentum, and an epiploic appendage established the diagnosis of miliary tuberculosis.

The postoperative course was complicated by an episode of supraventricular tachycardia with circulatory collapse and bronchopneumonia. Sputa and gastric washings were repeatedly negative for acid-fast organisms. The patient progressively improved and was able to leave the hospital on the twenty-second hospital day.

## CIRRHOSIS AND ALLIED CONDITIONS

Other cases studied by this method represent a variety of clinical entities involving the portal system. One patient presented a marked dilatation and tortuosity of the splenic and portal vein indicative of an uncompensated portal block, while another showed a normal caliber of the great veins of the portal system and a number of collaterals indicating that the flow from the portal to the caval system was adequate to maintain the portal pressure at a reasonable level. The speed with which the pathologic changes occur govern the degree of adaptation, slower development permitting more complete compensation.

These studies would further indicate that ascites is not the result of portal hypertension but reflects the presence of severe hepatocellular disease and disrupted protein metabolism, because

ascites was most severe in those patients with the least venographic evidence of portal hypertension.

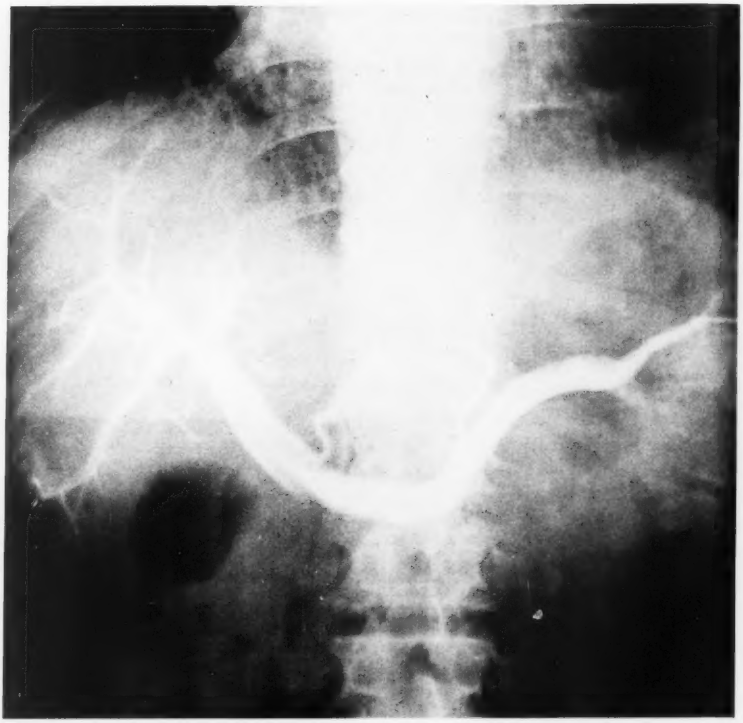

*Figure 6 (case 3). Portal venogram showing the splenic and portal veins to be of the expected normal caliber. Of special interest are the two large channels, one on either side of the vertebral shadow, which fill in retrograde fashion. The course toward the cardioesophageal junction indicates that there is retrograde flow from the portal to the caval system of veins and an element of portal hypertension.*

Case 4. A 50-year-old white woman entered the hospital complaining of distention of the abdomen. She had been hospitalized 6 months previously because of a gastrointestinal hemorrhage. She subsequently developed ascites which became progressively worse, necessitating frequent paracenteses yielding from 6 to 10 liters of fluid per tap. During this period she had varying degrees of edema of the lower extremities, and a very poor appetite. There was a history of alcoholism for a number of years.

The patient was pale, malnourished, and appeared chronically ill. The abdomen was tense and distended, with flank and shifting dullness.

The liver was palpable two fingerbreadths below the right costal margin and there was a 3-plus pitting edema of the lower extremities.

The pertinent laboratory studies revealed a marked anemia, hypoproteinemia with reversal of the A/G ratio, an elevated total serum bilirubin, and 21 percent retention of sulfobromophthalein dye in 60 minutes.

A splenic puncture was performed by the standard technic, using local 1 percent procaine anesthesia; 10 ml. of 35 percent urokon was injected and a portal venogram made (fig. 7).

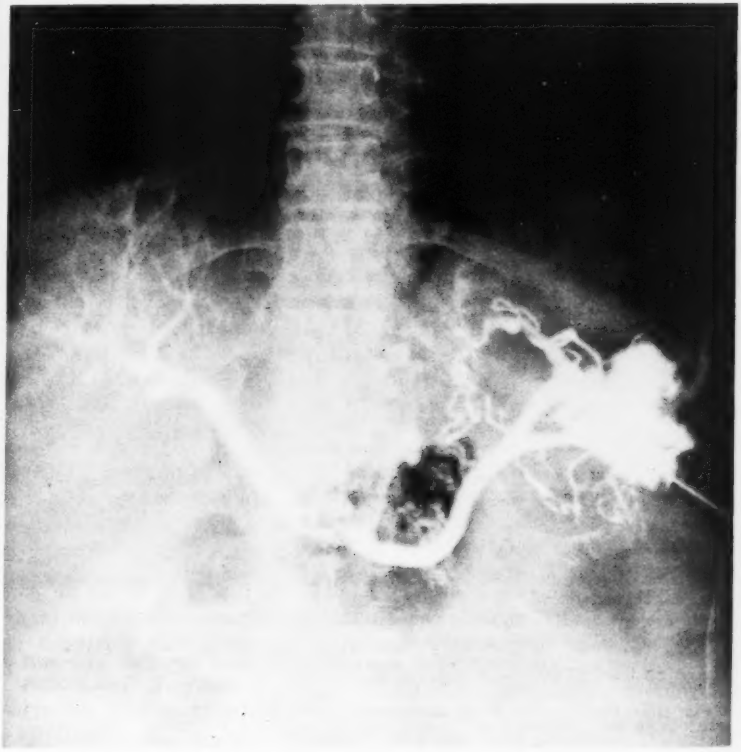

*Figure 7 (case 4). Portal venogram showing small-caliber splenic and portal veins pursuing a straight course. The ascites in this patient was not due to a portal hypertension, but was caused by severe liver disease and hypoproteinemia. It is possible that this patient did not have portal hypertension because of the wealth of small channels communicating with the caval system of veins, as noted here in the region of the splenic hilum.*

Three days later a liver biopsy was performed. The pathologic report was atrophic cirrhosis of the liver. The hospital stay was uncomplicated and the patient steadily improved on a regimen of adequate nutrition.

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Case 5. A 75-year-old white man came to the hospital because of upper abdominal pain. The pain first appeared 4 months prior to admission and was severe, constant, and localized in the right upper quadrant of the abdomen. Associated with the attack were chills, fever, a faint icterus, dark urine, and light-colored stools. The first attack lasted 1 day, but 2 similar attacks lingered for about 1 week. The patient complained only of obstipation between these attacks.

The past medical history included a cerebrovascular accident with a right hemiplegia in 1949. There was a residual spastic paralysis of the right upper extremity, recovery being otherwise complete.

There was a faint scleral icterus. The abdomen was soft and flat and the liver edge was palpable 2 cm. below the right costal margin. The direct reacting serum bilirubin was 2.2 mg. per 100 ml., and total bilirubin was 4.5 mg. per 100 ml. A cholecystogram revealed a nonfunctioning gallbladder with no evidence of radiopaque calculi. Gastrointestinal roentgen study was noncontributory.

Portal venography under local procaine and intravenous pentothal anesthesia was performed, using 15 ml. of 35 percent diodrast for the injection (fig. 8). The postvenography course was uneventful. Six days later the patient was returned to the operating room where a cholecystectomy and choledochostomy was performed for the removal of calculi. At the time of the laparotomy there was no evidence of intraperitoneal blood as a result of the previous splenic puncture, but there were soft, filmy adhesions between the diaphragm and the convex surface of the spleen.

The convalescent period was uneventful. A cholangiogram on the sixth day was normal and the patient has been asymptomatic to date. The final diagnosis was chronic purulent and ulcerative cholecystitis and cholelithiasis.

Case 6. A 78-year-old white man was admitted to the hospital with the provisional diagnosis of leukemia. For the past 6 weeks he had noticed a painful "lump" in the left upper abdomen. The patient complained of easy fatigability, anorexia, weakness, and shortness of breath on mild exertion.

The physical findings on admission revealed submaxillary, posterior auricular, cervical, and axillary lymphadenopathy. The spleen was palpated in the left upper quadrant of the abdomen and was greatly enlarged. The liver edge was palpable three fingerbreadths below the right costal margin. There was shotty inguinal lymphadenopathy.

The pertinent laboratory findings were a white blood cell count of 360,000, predominantly premature myelogenous cells, and marked anemia. The bleeding and clotting times were normal.

Roentgenographic studies of the bowel showed a soft tissue mass in the area of the spleen and diverticulosis of the sigmoid colon. The

patient received 4 pints of whole blood and was started on deep roentgen therapy to the spleen.

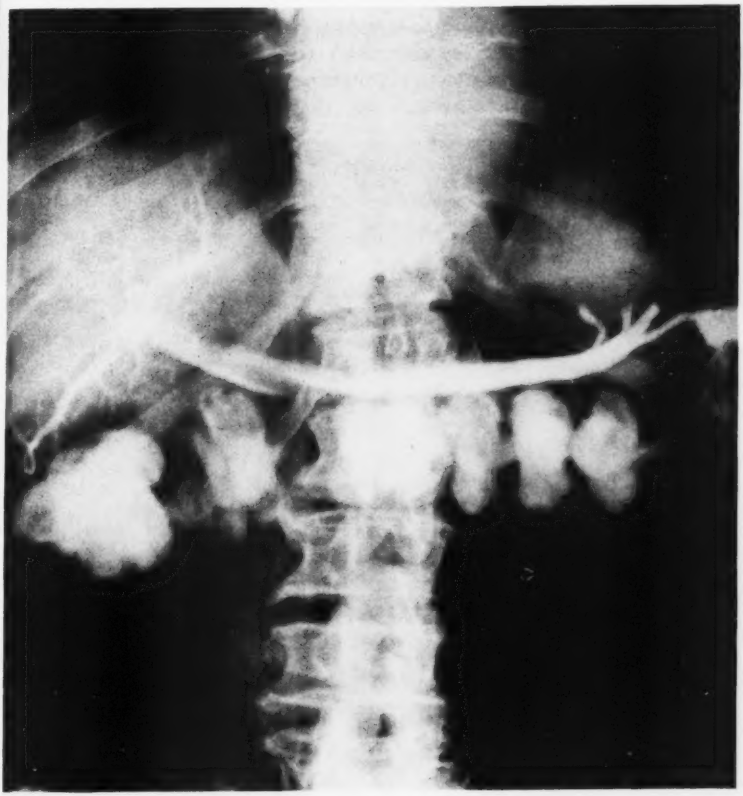

*Figure 8 (case 5). Portal venogram. The nearly straight, horizontal course of the splenic and portal veins is unusual. There is no visible filling of the left branch of the portal vein. Barium remains in the colon from the barium enema given 4 days previously.*

After being skin tested to diodrast, portal venography was performed using the standard method. Twenty milliliters of 70 percent diodrast was injected into the spleen. Local 1 percent procaine hydrochloride anesthesia was used in the skin and pentothal sodium was given intravenously to control respirations (fig. 9). The patient returned to his room awake and with a blood pressure of 140/68 mm. Hg. At that time he had no complaints.

A short time later the patient was found lying on the floor in a semiconscious state. He was immediately put to bed and an intravenous infusion of dextrose in water was started. The blood pressure at that

time was 100/50 mm. Hg, the same as at the time of admission. His sensorium promptly cleared. About midnight the patient began complaining of abdominal pain and nausea and soon thereafter he vomited bright red blood and coffee-ground material. Blood studies at this time were as follows: 3 million erythrocytes per cu. mm.; hemoglobin, 49 percent of normal; platelet count, 210,000 per cu. mm; bleeding time, 3 minutes and 25 seconds; clotting time, 2 minutes and 27 seconds.

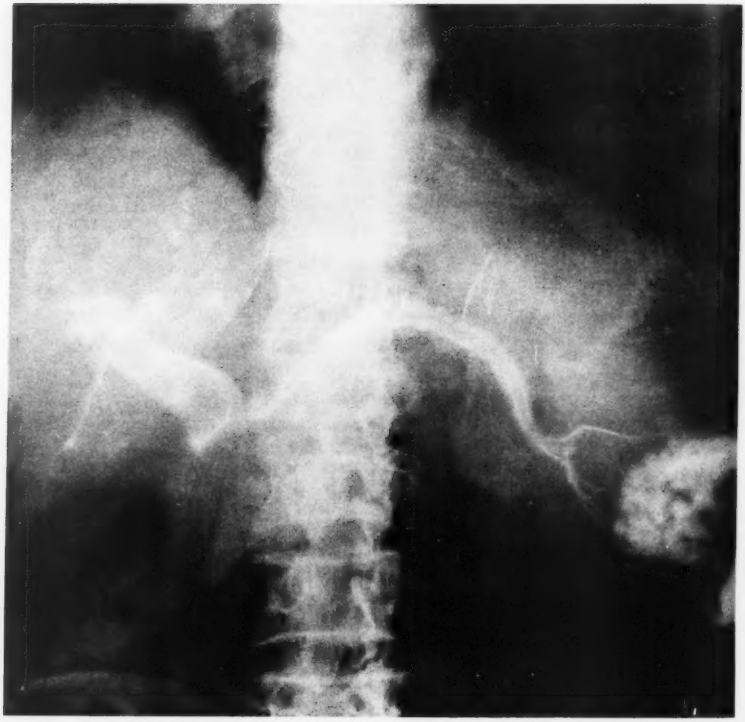

*Figure 9 (case 6). Portal venogram showing the splenic vein to be of normal size. The diameter of the portal vein is increased and the left branch is not visualized. The huge spleen made the splenic puncture technically easy to accomplish.*

A blood transfusion was started and a Sengstaken-Blakemore esophageal tampon tube was inserted. After 3 pints of whole blood, the blood count at 0800 hours the next morning was a red cell count of 3.64 million per cu. mm. and a hemoglobin 65 percent of normal. Two hours later the patient's pulse became rapid and thready and the abdomen became distended. Needle aspiration of the peritoneal cavity yielded bright red blood. The diagnosis of rupture of the spleen was made. Before the patient could be moved to the operating room he died. The red blood cell count immediately before death was 2.74 million per cu. mm.

The final pathologic diagnosis at postmortem examination was: Rupture of the spleen (3 mm.) with hemorrhage into the peritoneal cavity, estimated at 1,500 ml.; esophageal varices with perforation and hemorrhage; leukemic ulcerations of the stomach with hemorrhage; and chronic myeloid leukemia. There was a 4-cm. infarcted area at the site of the needle puncture, and the bleeding into the peritoneal cavity had been through a small 3-mm. rent in the splenic capsule made by the needle puncture.

It is believed that infarction of the spleen can be minimized by the use of 35 percent urokon or diodrast rather than the 70 percent preparation. It is impossible to say what part the venography played in precipitating the hemorrhage from the esophageal varices and gastric ulcerations, but the procedure undoubtedly hastened the fatal outcome.

Limitations of space preclude the detailed description of the other cases.

## COMMENT ON OPERATIVE PORTAL VENOGRAPHY

A factor of safety is added by performing portal venography at the time of laparotomy. I have used the spleen, omental veins, and branches of the inferior mesenteric vein for injection. By this technic the danger of hemorrhage is minimized because the vessel can be observed for bleeding and can be ligated if necessary. This technic is preferred if exploratory laparotomy is contemplated.

## CONCLUSIONS

In this article the history, indications, and contraindications of portal venography are discussed. The technic is described and typical venograms presented.

Portal venography by percutaneous splenic injection must be considered a calculated risk. The greatest hazard is hemorrhage. However, portal venography performed at the time of laparotomy is a safe and rewarding procedure. Portal venography should not be performed on patients who have a blood dyscrasia.

To lessen the danger of infarction of the spleen, percutaneous portal venography is preferably done with 35 percent urokon or diodrast rather than with the 70 percent preparations.

The "streamline" theory of portal blood flow does not hold true according to observations obtained by portal venograms made by percutaneous splenic injection.

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*Someone has said: A conclusion is the place where you got tired thinking.*—Martin T. Fischer

# CARBON MONOXIDE ASPHYXIA

WILLIAM D. CLAUDY, *Major, USAF (MC)*

OF ALL the gases causing accidental poisoning in time of peace, the most important is carbon monoxide. To any practicing physician, a knowledge of the physiology and pathology of carbon monoxide asphyxia is imperative, if lives are to be saved. The military physician must have an even more exhaustive knowledge of the subject, for not only must he treat the victims of such poisoning but he is frequently called on for consultative advice in the fields of prevention and personnel protection. He must have knowledge of the common sources of such poisoning within the military installation in which he serves. This includes not only the common hazards of everyday life, but the industrial hazards[1] present within his particular facility, the protective as well as the therapeutic requirements of military fire departments, and the particular carbon monoxide hazards inherent in specialized branches of the services.

Many physicians now entering the military service come from civilian practice where these questions are seldom encountered. Others come directly from internship or residency, where they may have had brief encounters with the treatment of patients with carbon monoxide poisoning, but have little or no knowledge of the preventive medicine aspect of the condition. Some of these physicians will serve in isolated bases, often outside of the limits of the continental United States, where this information is difficult to obtain. It is to this group in particular that this article is addressed. No attempt will be made to cover the highly specialized problems which may arise in the course of flight, marine or submarine activity, or military activities in connection with the conduct of hostilities.

## CARBON MONOXIDE: CHEMICAL ASPHYXIANT

Carbon monoxide is generally described as an odorless and tasteless gas, though it actually has a slight garliclike odor, which is slightly lighter than air. It is formed wherever the combustion of carbonaceous materials occurs. It falls in the class of chemical asphyxiants, which also includes the cyanides.

Asphyxiants generally can be divided into two classes: simple asphyxiants (such as nitrogen, carbon dioxide, and other non-

From 36th Tactical Hospital, APO 132, New York, N. Y. Dr. Claudy is now at 1746 K Street N. W., Washington, D. C.

toxic gases) and chemical asphyxiants. The latter can, in turn, be divided as to their site of action. Carbon monoxide causes asphyxiation by combining with the hemoglobin of the blood, thus preventing the transport of oxygen from the lungs to the tissues, whereas cyanide derivatives, by combining with cytochrome of body cells, prevent their utilization of the oxygen brought to them.

## AFFINITY OF HEMOGLOBIN

The affinity of hemoglobin for carbon monoxide is from 250 to 300 times as great as it is for oxygen. Thus, relatively small quantities of carbon monoxide, even when present in an atmosphere which is adequate in oxygen, may produce effects which may be fatal in a short time.

Carbon monoxide acts predominantly by forming a chemical combination with the hemoglobin of erythrocytes. All other immediate and remote effects of gassing are due to the resulting asphyxia. This asphyxia differs from that caused by simple suffocation because the presence of the carboxyhemoglobin radical in the blood, in addition to preventing the transport of oxygen by the involved hemoglobin molecules, also interferes with the dissociation of the remaining oxyhemoglobin (to oxygen and reduced hemoglobin) so that even the oxygen absorbed is less readily available to the body tissues than it would normally be. Further, under normal conditions, reduced hemoglobin acts as a catalyst for the liberation of carbon dioxide. If there is a decrease in the amount of available oxyhemoglobin (due to its conversion to carboxyhemoglobin) the removal of carbon dioxide may be hindered.

## COMBUSTION AND "SMOKE POISONING"

A common asphyxial accident due to carbon monoxide is "smoke poisoning" from accidental building fires. The military physician may be called on to treat both building occupants and firemen. He may have to direct and supplement the activities of lay rescue squads. Hence a knowledge of the physical and chemical occurrences within burning structures is necessary.

During the combustion of ordinary everyday household materials, various amounts of carbon monoxide are formed. The amounts depend on several variables. These are the amount and type of material involved in combustion, the amount of oxygen available, and the temperature. Some idea of the amounts of carbon monoxide eliminated by the combustion of various substances may be gained by studying table 1. These figures represent total percentages of gases evolved, and not the volume percent in a given atmosphere. Thus, the smouldering burning of a small

pile of newspapers in a large open hall would give an entirely different concentration of carbon monoxide and dioxide within the atmosphere than if burning in a small enclosed basement.

TABLE 1. *Percentage of carbon monoxide and carbon dioxide produced by combustion*

| Material | Excess oxygen | Limited oxygen |
|---|---|---|
| Wood | 1.9% CO<br>7.6% $CO_2$ | 2.7%<br>5.7% |
| Newspapers | 6.4% CO<br>6.6% $CO_2$ | 41.0% (plus low temperatures<br>43.0% as when smouldering) |
| Rubber | 10.1% CO<br>20.1% $CO_2$ | -<br>- |
| Wool and silk | 6.8% CO<br>13.4% $CO_2$ | 17.7% CO<br>33.1% $CO_2$ |

Nevertheless, the percentage of carbon monoxide to be expected during the progress of any extensive structural fire is considerable, and has been estimated as high as 6 percent.[2] I have secured determinations ranging from 2 to 4 percent from the smoke of building fires in the same room in which firemen were engaged in extinguishment.[3]

## USUAL CANISTER-TYPE MASK INADEQUATE

In the extensive literature on the hazards of carbon monoxide poisoning, most work deals with dangerous accumulations of far less than 1 percent. Canister-type masks commonly used by fire departments are designed for atmospheres in which the carbon monoxide content does not exceed 2 percent. It would seem that the practical firemen and the engineers designing some of their protective equipment have yet to establish a common goal.

Carbon monoxide has a density of 0.967 as compared to air and is therefore slightly lighter than air. When heated, it is considerably lighter. Fire fighters are familiar with the fact that the hot gases of combustion automatically seek the highest level. I have repeatedly demonstrated by fireground measurements that concentrations in burning structures where firemen are actually working may reach dangerous levels in the areas from 6 to 12 inches below the ceiling, in stair wells and in attics and cocklofts, where no actual fire exists, and yet the atmosphere in the remainder of the building be entirely safe for unmasked men for considerable periods of time. All fireground ventilation practices are based on this principle.

Many modern, fire-resistive structures, which may be filled with combustible material, are however exceedingly difficult to ventilate, forcing firemen to seek other methods of protection.

## ILLUMINATING GAS AS SOURCE OF CO

There are many other important sources of carbon monoxide which may cause acute asphyxia on military establishments. Illuminating gas, which may be either coal, water, or natural gas, is a common source of acute poisoning which is often suicidal in intent. Coal gas, which is made by the destructive distillation of coal, contains from 4 to 6 percent of carbon monoxide. Water gas, which is made by passing steam over heated coke, contains up to 40 percent carbon monoxide. In many American cities, illuminating gas is composed largely of water gas, enriched either with coal gas or petroleum products to increase luminosity and enrich its heat-producing capacity. Hence, such gas may contain from 6 to 30 percent carbon monoxide. An odorant such as skunk oil is frequently added to make the accidental escape of gas more easily detectable.

When such gas, mixed with air before being burned, shows a blue flame, all the carbon monoxide which it contains is oxidized to the relatively harmless carbon dioxide. When this blue flame is brought in contact with cold bodies such as cold water pipes or cooking vessels filled with cold water, it is chilled. As a result, not only may the carbon monoxide in the gas escape combustion, but carbon monoxide may even be formed from other carbonaceous gases. Such production of carbon monoxide may occur even from natural gas, which is chiefly methane and contains no carbon monoxide, when it is used in water heaters and similar devices. The same is true of gasoline-burning stoves of the primus type.

## COMPRESSED AND LIQUEFIED GASES

Compressed and liquefied gases such as propane which are sold for domestic cooking and heating purposes may also be hazardous. Propane contains no carbon monoxide and is generally acknowledged to be a safe and convenient fuel. Because of this fact, some municipalities neglect to require, as they should, that heaters be connected with chimneys to carry off the products of combustion. When such devices are fully open, combustion is usually complete to carbon dioxide and water, but if the supply of gas is turned down until one or more of the burners goes out, while the others continue to burn, the gas escaping from the unlighted outlet may undergo a flameless and incomplete combustion, producing both considerable amounts of aldehydes and carbon monoxide. Several such deaths have been investigated by the laboratory of applied physiology at Yale University.[4]

When death from carbon monoxide poisoning occurs in one of these ways, the claim is often made that death was not caused by carbon monoxide because no gas leak occurred or the gas did not contain carbon monoxide, and that death must have been due to the consumption of all the oxygen in a tightly closed room and to an excess of carbon dioxide. Actually, the low oxygen would have extinguished the fire long before it seriously affected human beings, and the excess carbon dioxide would instead have deepened and stimulated respirations.

## CO IN SMOKE FROM COAL FIRES

Smoke from coal fires contains carbon monoxide, the amount depending on how free the draft may be. Banked fires, with dampers closed, tend to produce higher concentrations than those freely burning, hence back drafts, cracks, or leaks in the burning chamber or the flues may produce carbon monoxide poisoning. For obvious reasons, such cases occur more readily when severe weather has moderated, or at night, when the fires are banked and while the occupants of a building are asleep.

The use of salamanders, sometimes used to dry plaster in nearly completed structures, may produce fatal poisoning, particularly when a lone watchman checking the premises is overcome and there is no one nearby to sound an alarm or effect a rescue.

## BURNING GASOLINE AND CO

The percentage of carbon monoxide resulting from the burning of gasoline has been variously estimated at from 0.6 percent (freely burning),[2] 1 to 7 percent from the exhaust gas of internal-combustion engines,[3] 4 to 13 percent,[5] and 7 percent.[6] That a large and important hazard does exist, however, is generally conceded, and the publication of widespread information on this subject has made the public generally aware of the hazards of operating automobile motors in small, closed buildings. Paradoxically it has also increased the number of effective suicides by this method. That dangerous concentrations of gas can develop insidiously within the driving compartment of a car being operated on the open road, impairing the judgment and reaction time of the driver and thus causing many otherwise unexplained accidents, has also been amply demonstrated[7, 8] although this fact has gained far less acceptance by the general public. Although diesel engines produce less carbon monoxide than gasoline engines usually do, they are by no means free from this hazard. Portable generators, pumps, and other apparatus powered by gasoline motors frequently are found on military bases and may constitute a severe hazard. All of the cases of acute carbon monoxide asyphxia treated at the 7424th U. S. Air Force

Hospital in the past 14 months have arisen from this latter source.

Carbon monoxide is also a hazard in many occupations, some of which may be found within the limits of military establishments. These include blacksmithing; kiln, foundry, and smelter work; fumigation; garage and filling station duties; laboratory service of various types; telephone and electric installation (trench and manhole work); furnace stoking; and many others.

The chemical principles of asphyxiation with carbon monoxide have already been pointed out. Let us consider the clinical picture of acute carbon monoxide asphyxiation. The clinical effects of various percentages of carbon monoxide in air are shown in table 2.[9]

TABLE 2.

| *Percent of CO in air* | *Effects* |
|---|---|
| 0.02 | Possible mild frontal headache in 2 or 3 hours. |
| 0.04 | Frontal headache and nausea after 1 to 2 hours; occipital headache after 2½ to 3½ hours. |
| 0.08 | Headache, dizziness, and nausea in ¾ hour; collapse and possible unconsciousness in 2 hours. |
| 0.16 | Headache, dizziness, and nausea in 20 minutes; collapse, unconsciousness, and possible death in 2 hours. |
| 0.32 | Headache and dizziness in 5 to 10 minutes; unconsciousness and danger of death in 30 minutes. |
| 0.64 | Headache and dizziness in 1 to 2 minutes; unconsciousness and danger of death in 10 to 15 minutes. |
| 1.28 | Immediate effect; unconsciousness and danger of death in 1 to 3 minutes. |

The effects of carbon monoxide blood absorption can also be listed as shown in table 3.

The exact level of carboxyhemoglobin in the blood at which consciousness is lost is still not a matter of complete agreement, but most authorities agree that the level is between 40 and 50 percent.

Likewise the times given in table 2 for development of symptoms with a given concentration can only be used as a general guide, because they are considerably altered by such variables

as exertion, depth of respiration, excitement, fear, pre-existing anemia or other factors affecting general bodily vigor, and altitude (partial pressure of oxygen). In a series of self-experiments Haldane[10] showed that the effects are most marked on the central nervous system. After preliminary symptoms of nausea, headache, dizziness, confusion, and abdominal pains, he passed into a condition like that of acute alcoholism in which his judgment was lost, but he was unable to realize that his mind was not as clear as ever.

TABLE 3.

| *Percent of carboxyhemoglobin* | *Effects* |
|---|---|
| 10 | No appreciable effect except shortness of breath on vigorous muscular exertion. |
| 20 | No appreciable effect in most instances, except shortness of breath even on moderate exertion; occasionally slight headache. |
| 30 | Decided headache, irritability, easy fatigability, disturbed judgment, shortness of breath. |
| 40-50 | Headache, confusion, collapse, and fainting on exertion. |
| 60-70 | Unconsciousness, respiratory failure, and death if exposure is long continued. |
| 80 | Rapidly fatal. |
| Over 80 | Immediately fatal. |

This is a matter of considerable importance on the scene of an asphyxial accident, particularly when the casualties are multiple. Unless careful observation and control of victims who have been treated for carbon monoxide asphyxia is maintained, they may insist on returning to the dangerous atmosphere to attempt the rescue of loved ones, or perhaps to secure personal valuables. This applies to firemen as well as to ordinary victims of asphyxia. Indeed, the compulsion and excitement may be so great that the erstwhile patient will actually struggle with his rescuers. I have been struck in the face and cursed by a fireman whom I attempted to prevent returning to a fireswept building after he had partially recovered from the effects of carbon monoxide inhalation. Later, he assured me that he had little recollection of his behavior which was quite out of line with his usual reasonable and agreeable character.

It is also readily apparent, that if consciousness is regained when there is still a high (30 to 45 percent) concentration of carboxyhemoglobin in the blood, not only will judgment be faulty,

but strength will be impaired, and it will take only a relatively minor re-exposure to the gas to bring a speedy return of unconsciousness. In fire departments where morale is high, firemen pride themselves on their ability to "take it," to "eat smoke" under tough and dangerous conditions, little realizing that their attitude will jeopardize not only their own lives, but that of their fellows who may be called on to attempt their rescue.

The anoxemia induced by carbon monoxide does not cease as soon as fresh air or oxygen is inhaled, as is the case with the simple asphyxiants such as carbon dioxide, but persist for a considerable period, in diminishing degree until all of the gas has been eliminated from the blood. Even with the simple asphyxiants, the after effects of anoxemia, headache, disturbed judgment, and impairment of other bodily functions persist for some time after ample oxygen is restored to the blood. This is because (1) an oxygen debt is built up in the tissues, and this equilibrium must be restored in addition to that between oxygen and hemoglobin; and (2) actual pathologic changes in the tissues may occur after prolonged anoxemia. These are principally in the brain; small petechiae, punctate hemorrhages, and perivascular edema occur. Cellular degeneration occurs in the corpus striatum, the lenticular nucleus, and the globus pallidus. Though for the most part, complete recovery is the rule, these changes may be permanent if the gassing is severe and prolonged.

Though active treatment can shorten the period of recovery, it is wise to set minimum time limits before permitting the resumption of normal activity. Generally, anyone exposed sufficiently to carbon monoxide fumes to require treatment should not return to work in less than 4 to 6 hours, while those who have been rendered semiconscious or unconscious, even for short periods of time, should rest for from 24 to 48 hours. If unconsciousness persists for more than 15 minutes after return to fresh air, or the start of oxygen therapy, hospitalization is indicated.

The treatment of carbon monoxide asphyxia depends on its dissociation from hemoglobin and its replacement by oxygen. This dissociation does not proceed at the same rate as does the formation of carboxyhemoglobin. Instead it proceeds gradually, depends on the mass action of oxygen, and is roughly proportional to the percentage of oxygen used in treatment. After brief exposures to high concentrations of the gas, with rapid absorption, the effects of anoxemia may be suffered largely after the victim has been removed from the contaminated atmosphere.

Because anoxemia may cause serious damage to brain and other tissues, it is of extreme importance to hasten the elimination of carbon monoxide and thus shorten the period of postgassing asphyxia.

Henderson and Haggard[4] attempted to show the importance of progressive loss of carbon dioxide in carbon monoxide poisoning and advocated the use of oxygen-carbon dioxide mixtures in the treatment of this condition, but these theories find little support today. The concensus is that pure oxygen inhalation is the treatment of choice, and that the possible minor advantages claimed for carbon dioxide mixtures are more than offset by the loss of the additional oxygen which would be available in the mixture.

## ARTIFICIAL RESPIRATION

In many cases where exertion prior to gassing has been short and violent, carbon dioxide in considerable amounts may already be present in the blood stream and the addition of more carbon dioxide may actually be harmful. In any case, carbon dioxide inhalations are of value only to the already breathing patient. In the nonbreather, who is most in need of resuscitation, artificial respiration either by manual push-and-pull methods or by a properly operated mechanical resuscitator is required to deliver oxygen to the lungs, and this oxygen will be supplied regardless of the presence of carbon dioxide in the blood stream, the respiratory center, or the resuscitating gas. The U. S. Air Force has set 4 percent carbon dioxide as the maximum safe amount permissible in a breathable atmosphere, stating that at from 5 to 10 percent, failure of compensatory reactions and deterioration may occur,[11] and recommends 100 percent oxygen as the treatment of choice.

Treatment should consist of the following procedures. The victim should be removed to fresh air as speedily as possible, but care should be taken against chilling the body. If the victim is breathing spontaneously, 100 percent oxygen should be administered by closed-system inhalators. If breathing is absent or slow, artificial respiration, either manual or by means of properly operated resuscitators delivering 100 percent oxygen, should be used. Manual artificial respiration should be of the push-and-pull type and should be either arm-lift back-pressure (Holger-Nielsen), hip-lift back-pressure, or Silvester method, because these methods give the greatest volume of air exchange[12] supplemented where possible by an inhalator supplying 100 percent oxygen.

After consciousness returns, the patient should be kept supine or semirecumbent and perfectly quiet, and inhalations of oxygen should be continued for variable periods. Appropriate antishock measures should be undertaken in every case.

## DETERMINATIONS OF BLOOD CO LEVEL

Whenever possible, the duration of oxygen therapy should be controlled by repeated determinations of the blood carbon monoxide level. An effective, rapid, convenient, and reasonably ac-

curate method for making such determinations either at the bedside or under field conditions is commercially available. It depends on quantitative color changes induced in a measured amount of tannic acid and pyrogallol when brought into contact with a measured amount of blood from a patient who has been exposed to significant amounts of carbon monoxide.[2] The presence of carbon monoxide can be determined within 5 minutes and the approximate amount within 15 minutes.

Such determinations are of great value in following the course of and determining the duration of treatment for a carbon monoxide asphyxia victim as well as in determining whether unconsciousness is due to simple asphyxia or to carbon monoxide intoxication. When such determinations are impractical, a good rule of thumb is to give 1 hour of oxygen therapy for every 10 minutes of unconsciousness. They are also of great value in determining the part played by carbon monoxide intoxication in vehicle and aircraft accidents. In fatal accidents, determinations should be made on heart blood, withdrawn as soon as possible after the accident. Valuable evidence can be obtained in this way for presentation to a coroner's jury, and for various other medicolegal matters which may arise in connection with asphyxial accidents.

## RESPIRATORY STIMULANTS AND BLOOD TRANSFUSIONS

The use of respiratory stimulants such as caffeine and sodium benzoate and others is of questionable value, but cannot do too much harm, provided their administration is delayed until oxygen therapy has been commenced. Blood transfusion is of little value. Recently exchange transfusion has been suggested in therapy of this condition. In theory it may be valuable, but I have had no experience with it. The formerly advocated administration of methylene blue is definitely harmful and contraindicated. During the period of acute poisoning, the blood pressure should be determined frequently, and where systolic levels are low, the use of levophed (brand of levarternol bitartrate) and plasma volume expanders such as dextran are helpful.

Carbon dioxide inhalation is unnecessary and undesirable in lay hands, and is contraindicated in most cases. The same respirators are often used in the treatment of drowning, electrocution, and other causes of respiratory failure where carbon dioxide deficiency can play no part. Because simplicity and speed of operation in the administration of oxygen are the key to successful treatment and because, at best, the addition of carbon dioxide to oxygen in the treatment of victims of carbon monoxide poisoning is of minor and questionable value, 100 percent oxygen should be the treatment of choice and should be carried out in all cases.

The old adage "Prevention is better than cure," is good advice. The use of masks where noxious atmospheres are anticipated is of great value, and the military physician may be called on to guide the selection of such masks.

## THE ALL-PURPOSE CANISTER MASK

The all-purpose canister mask is the commonest safety device of this type, both in industry and in American fire departments. Many types of canisters are available, designed for particular asphyxiants, but only the "all-purpose" canister has any place in fire fighting and rescue work. This canister contains activated carbon (to remove organic vapors), soda lime (to remove acids and carbon dioxide), copper sulfate (to protect against ammonia gas), calcium chloride (to prevent moisture from entering the canister), and hopcalite (a mixture of metallic oxides which catalyses the combustion of carbon monoxide from the air to form carbon dioxide), plus a filter pad for smoke. It can be used as protection against smoke and gases which do not exceed 2 percent by volume where adequate amounts of oxygen to support life remain in the contaminated atmosphere. The practical limit is said to be 17 percent oxygen in air, although life is not actually endangered until the concentration falls to 14 percent. It must be remembered, however, that such masks are generally worn when the wearer is engaging in vigorous physical effort, hence while oxygen demand is increased.

There is an inherent resistance in all such masks from breathing the air through the various deactivating chemicals. This resistance definitely increases the total effort the wearer is required to make. If concentrations in the air exceed the absorbing ability of the mask (for example, should the air contain 30 percent carbon monoxide and the mask be capable of filtering only 3 percent), disastrous results will occur. In fact, the danger may be greater than if no mask were worn, for the canister, by removing the irritating smokes and fumes which might otherwise prevent the wearer from penetrating the dangerous atmosphere, may allow him to go sufficiently far so as to impede his own rescue if collapse occurs. Also important is the fact that hopcalite and other constituents of the all-purpose canister may be inactivated if they become wet or moist. In addition, the mask is subject to the usual effects of age and deterioration of the rubber tubes and facepieces. The mask has a timer, indicating the remaining life of the canister, which should be carefully watched by the wearer. When the timer indicates that the canister is two thirds exhausted, the wearer should leave the contaminated atmosphere and obtain a new canister. The canister mask, then, has many limitations which may render it dangerous, particularly in inexperienced hands. Its main "virtue" is its relatively low cost. It should be strongly emphasized that military

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gas masks, designed for protection against chemical warfare agents, *do not protect against any concentration of carbon monoxide,* and should *never* be used for this purpose.

## SELF-CONTAINED MASKS

Self-contained masks are entirely independent of the atmosphere in which the wearer works. They are of several types. The hose mask and air pump is the simplest, but for various reasons has failed to find much favor. Another type of self-contained mask, which found considerable use in the past but is gradually being replaced today, is an apparatus in which a soda-lime container removes the carbon dioxide from the used air, and the remaining oxygen, augmented by a fresh supply, is circulated back to the wearer through a bellows. This apparatus, while independent of the outside atmosphere and not having the restricting features of a hose mask, is complicated and cumbersome, requires unremitting vigilance to keep it safe, and still provides some resistance to breathing. Its chief asset is the relatively long (1 hour) period which it can be used without replenishment.

A self-generating oxygen canister, which is likewise independent of the outside atmosphere, has been developed. Moisture in the breath activates certain chemicals within a canister which evolves breathable oxygen. This is circulated to the wearer by means of a bellows arrangement. This mask provides the longest period of wearability. Its disadvantages are that the canisters are relatively expensive, may react violently if immersed in water (as by an accidental fall by the wearer during use), and are bulky and complex to operate.

## DEMAND-TYPE MASK

The most popular self-contained mask in use at the present time is the so-called "demand-type" mask. This mask supplies either air or oxygen "on demand" to the wearer by means of a high pressure tank, worn on the back or slung at the side, which in turn is connected to a reducing valve and chamber. A demand valve, which is opened by the wearer's inhalation, supplies unlimited amounts of pure air or oxygen to the user. Masks of this type are certainly the easiest to breathe and work in, but are heavy, bulky, and relatively expensive. The maximum useful period of the larger models is 30 minutes, but if worn by a large man doing heavy physical work, may fall considerably below this time period. Such masks should never be used "solo" but always in pairs—because, should the user himself need rescue, only another mask wearer can help him.

The question of the late effects of acute carbon monoxide poisoning is often raised in medicolegal and retirement cases.

Chronic carbon monoxide poisoning is not considered here, but the late effects of acute poisoning may be of interest to those concerned with medicolegal cases, disability, and retirement.

The majority of cases of acute carbon monoxide poisonings recover without any residual effects. If acute poisoning is severe and prolonged, however, symptoms may appear and persist. These are symptoms which are common to any prolonged and simple asphyxia, for there is no chemical reaction of carbon monoxide with either blood or tissue. They are most prominent in relation to the tissues of the nervous system, and may include chronic headaches, personality changes, memory lapse, partial paralysis, and sensory disturbances. That these are very rare however, was demonstrated by Shillito and associates[13] who investigated more than 21,000 cases of acute carbon monoxide intoxication in the New York City area. His figures showed that only 1 in every 500 persons so poisoned developed nervous or mental symptoms, and that for every case of psychosis from this cause, there were 2,000 cases from other causes. Drinker and Cannon[14] surveyed the hospital records of 21,143 victims of acute carbon monoxide poisoning, mostly nonindustrial. They found 514 severe cases in victims who were unconscious on admission. Of these, 116 died. Permanent mental or nervous damage was shown in only 39 of the 398 survivors, and in all instances this had followed long periods of exposure and unconsciousness. The question of heart damage is sometimes raised in medicolegal cases.[15] While it is undoubtedly true that the heart which harbored pre-existing disease may suffer further insult as a result of the superimposed anoxemia, the concensus is, that aside from this expected imposition placed upon the heart at the time of the gassing, there persists no cardiac damage.

Henderson and Haggard[4] established three conditions which should be met in order to justify a claim of permanent damage after severe acute carbon monoxide exposures: (1) at least a 50 percent saturation of the blood, or a concentration of carbon monoxide in the air sufficient to induce at least this degree of saturation; (2) an exposure of at least 3 hours; and (3) continuous complete unconsciousness lasting for at least 6 hours after return to fresh air. They stated that recovery is practically always complete except perhaps in situations of such severity.

In any discussion of acute carbon monoxide poisoning, such as is encountered in accidental fires, it must be borne in mind that seldom is only one gas or vapor encountered. In addition to carbon monoxide, smoke contains other toxic gases, such as carbon dioxide, ammonia, hydrogen sulfide, hydrocyanic acid, and nitrogen oxides, which even in low concentrations may induce pulmonary edema, as well as an aerial concentration of minute solid particles which are highly irritating. There is ample

evidence to show that the effect of the toxicity potential of two or more gases or vapors is more than additive.[16]

## SUMMARY

The hazards of carbon monoxide poisoning are of particular interest to the military physician, for it is an ubiquitous gas which may be encountered on almost any military installation. This article reviews the pathologic physiology and clinical picture of carbon monoxide asphyxia and the sources and concentrations of the gas evolved under various conditions.

In the treatment of acute carbon monoxide asphyxia it is emphasized that the inhalation of 100 percent oxygen, supplemented whenever indicated by artificial respiration of the push-and-pull type or by properly operated and approved resuscitators, is the sheet anchor of adequate therapy.

Individual protection by means of various types of masks is considered and the advantages and disadvantages of each type are presented. Because of their interest to medical officers concerned with disability and retirement, the problems of late effects of acute carbon monoxide asphyxia are discussed and the principles of establishing a justifiable claim are set forth.

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# SUBSTITUTES FOR AND ADJUNCTS TO ATROPINE IN NERVE GAS POISONING

J. HENRY WILLS, *Ph. D.*

NERVE GASES produce three types of functional change[1]: (1) choline-like effects on the glands and smooth muscles of the gastrointestinal, genitourinary, and respiratory tracts, the circular smooth muscle of the iris, the sweat glands, and the heart; (2) nicotine-like effects on skeletal muscles, ganglia, and the adrenal glands; and (3) facilitation and, with larger doses, inhibition of synaptic transmission in the central nervous system.

The symptomatic treatment of nerve gas poisoning has consisted of the administration of atropine, or drugs with similar actions, to stop the choline-like and the central nervous system effects. In general such drugs have very slight, if any, effect on the nicotine-like actions. The most important of this latter group of effects, paralysis of voluntary muscles, has been combated by artificial respiration.

Through the co-operation of various pharmaceutical companies, the pharmacology branch of this installation has been able to test a large group of synthetic compounds for efficacy against nerve gas poisoning in laboratory animals. The standard test animal for these studies has been the rabbit. Unanesthetized white rabbits of unselected sex are injected through a marginal ear vein with 2 mg./kg. body weight of atropine sulfate or one of the test drugs. Two minutes later the animals receive, through the same vein, an injection of twice the $LD_{50}$ of nerve gas. Those drugs which save more than one half of the animals from dying with this dose of poison are then tested in the same way with four $LD_{50}$'s of nerve gas. The dose of nerve gas is increased by increments of two $LD_{50}$'s until a level is reached at which the drug saves less than one half of the group. Drug mixtures were tested in the same way.

At the present time two groups of drugs contain those synthetic compounds which seem most likely to yield satisfactory replacements for atropine. One of the groups consists of *darstine* (brand of mepiperphenidol), *diparcol* (brand of 10-(β-diethylaminoethyl)-phenothiazine hydrochloride), *monodral* (brand of penthienate

From Chemical Corps Medical Laboratories, Army Chemical Center, Md.

bromide), *neotropine* (brand of 2-diethylaminoethyl (2-cyclopenten-1-yl)-2-thienylacetate hydrochloride), *pro-banthine* (brand of propantheline bromide) and *systral*, which either are available commercially or are being considered seriously for marketing; the other group consists of newer experimental drugs designated by numbers *19, 92, 318, 2850, 2973,* and *3192,* which have not yet been put on the market. In general, the drugs in the latter group of compounds are more potent, and somewhat more toxic, than those in the former group.

These two groups of compounds are comprised largely of derivatives of N-diethylaminoethanol, with the ester linkage being the predominating type between this moiety and the remainder of the molecule. Table 1 illustrates the effectiveness of several of these compounds.

TABLE 1. *Potencies of 2 mg./kg. doses of various compounds against four $LD_{50}$'s of nerve gas in the rabbit*

| Drug | Mortality | |
|---|---|---|
| | Number died | Number tested |
| Atropine sulfate | 6 | 6 |
| Darstine | 3 | 6 |
| Monodral | 2 | 6 |
| Pro-banthine | 4 | 6 |
| No. 19 | 1 | 6 |
| No. 92 | 2 | 6 |
| No. 318 | 2 | 6 |

The rabbit tends to exaggerate the efficacies of the synthetic compounds as compared with that of atropine, probably because of the existence of a potent atropinesterase in this species to a greater extent than in most other mammals.[2-6] Drugs which have been found to be highly active in the rabbit are also of comparatively high activity in the rat, the cat, the dog, and the monkey. In the latter species, however, in contradistinction to the rabbit, no drug has been found to be markedly more active than atropine. Although all of the compounds listed in table 1 are more effective than atropine sulfate in the rabbit, none of them are more effective than atropine sulfate in any of the other animal species studied. Therefore none of them are sufficiently effective and innocuous to warrant their displacing atropine as the standard anticholinergic drug for treating nerve gas poisoning. Experimental work on the

symptomatic treatment of intoxication by nerve gases now is centered, therefore, on finding adjuncts to atropine.

Compounds which increase the lifesaving effectiveness of the standard dose of atropine have been found among the following groups of drugs: anticonvulsant, adrenolytic, curarimimetic, ganglion-blocking, locally anesthetic, prostigmine-like, and the weakly anticholinergic with central depressant action. The following commercial [*darstine, pendiomide, pentamethonium, prenderol* (brand of 2,2-diethyl-1,3-propanediol), *pronestyl* (brand of procaine amide hydrochloride), and *thorazine* (brand of chlorpromazine hydrochloride)] and experimental drugs (Nos. *144, 227, 253, 2642, 2920,* and *3258*) seem to have the best combination of activity and low toxicity. Among these adjuncts, the experimental group is definitely more toxic on the whole than the commercial group, but is also more active.

The 12 compounds in these two series fall into the following types: anticonvulsant, ganglion-blocking, locally anesthetic, and weakly anticholinergic with central depressant actions. Antiepileptic drugs like *dilantin* (brand of diphenylhydantoin sodium), *dimedione, paradione* (brand of paramethadione), and *tridione* (brand of trimethadione), have not been found to have adjunctive value in experimental animals, although alone they are capable of preventing grand mal-like electroencephalographic seizures and convulsions induced by nerve gas.[7] Atropine also prevents these effects.[8] Examples of the effectiveness of mixtures of adjuncts and atropine are given in table 2.

TABLE 2. *Potencies of mixtures of adjuncts with 2 mg./kg. of atropine sulfate against four $LD_{50}$'s of nerve gas in rabbits*

| Adjunct | Dose | Mortality | |
|---|---|---|---|
| | | Number died | Number tested |
| None | – | 6 | 6 |
| Pentamethonium | 5 mg./kg. | 3 | 6 |
| Pronestyl | 40 mg./kg. | 1 | 6 |
| Thorazine | 4 mg./kg. | 1 | 6 |
| No. 144 | 125 μg./kg. | 1 | 6 |
| No. 227 | 500 μg./kg. | 0 | 6 |
| No. 2642 | 2.5 mg./kg. | 0 | 6 |

It appears also that combinations of two different adjuncts with atropine can have more pronounced effects in experimental ani-

mals than either combination of adjunct and atropine. An example of this sort of finding is given in table 3.

TABLE 3. *Potencies of certain adjuncts with 2 mg./kg. of atropine sulfate against two $LD_{50}$'s of nerve gas in rabbits*

| Adjunct | Dose (mg./kg.) | Mortality | |
|---|---|---|---|
| | | No. died | No. tested |
| None | — | 3 | 6 |
| Prenderol | 5 | 3 | 6 |
| Pronestyl | 20 | 2 | 6 |
| Prenderol + Pronestyl | 5 + 20 | 1 | 6 |

Effort also has been made to find drugs capable of reversing the paralysis of skeletal muscle induced by larger doses of nerve gas. N-benzyl and N-phenacyl atropinium compounds have the desired effect as well as series of bis (ammonoethyl) derivatives of oxamide. Atropine itself however and the N-methyl and N-isopropyl atropinium compounds do not.

## SUMMARY

At present no treatment other than large doses of atropine, careful clearing of the airway, and effective artificial respiration can be recommended for treatment of severe nerve gas poisoning. The possibilities that adjuncts to increase the effectiveness of atropine and that specific antagonists to nerve gas[9] can be found appear to be good, but further research on animals and man is required before definite recommendations can be made.

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# REPORTING MILITARY MEDICINE

ROBERT J. BENFORD, *Colonel, USAF (MC)*

NEVER before in the peacetime history of this nation have such great numbers of American physicians, dentists, and allied scientists engaged in the practice of their profession in so many areas in the world. Today about 3 out of every 10 officers of the medical services on duty in our military departments are serving outside of the United States. This unprecedented situation—arising from the need for professional support of our occupation troops and their families, for our far-flung military missions, and for those strategic forces allied with the NATO nations—is extending the most recent advances of American medical research and practice to the four corners of the earth. It has likewise created global opportunities for personal achievement by these officers—achievement that is attained in everyday performance of duty.

Schooled in the high standards of this country, these military physicians and dentists are serving as medical ambassadors of the American system of professional education. Their influence on the health conditions in many overseas communities is inestimable; nevertheless, it is positive and far-reaching. In their relation with local civilian physicians there is always an exchange of knowledge, because learning never stops. The current literature of this specialty is being created today by the hundreds of American physicians in the armed services, here and overseas, who are writing accounts of their professional observations and clinical achievements.

In Turkey recently a U. S. Army doctor aided in tracing the source of an epidemic of typhoid fever among immunized soldiers of that country. In Saudi Arabia medical officers have encountered a variety of tropical diseases that are rarely observed in this country. Reporting from a hospital ship, two Navy surgeons performed what are believed to be the first cardiac operations on native patients in Korea. An enterprising dental officer apparently has solved some of the problems involved in making dental appointments with members of a ship's crew.

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Presented on 29 November 1954 at the 61st annual meeting of Association of Military Surgeons, Washington, D. C. Col. Benford, formerly Editor, *U. S. Armed Forces Medical Journal*, is now assigned to the Office of the Assistant Secretary of Defense (Health and Medical), Washington, D. C.

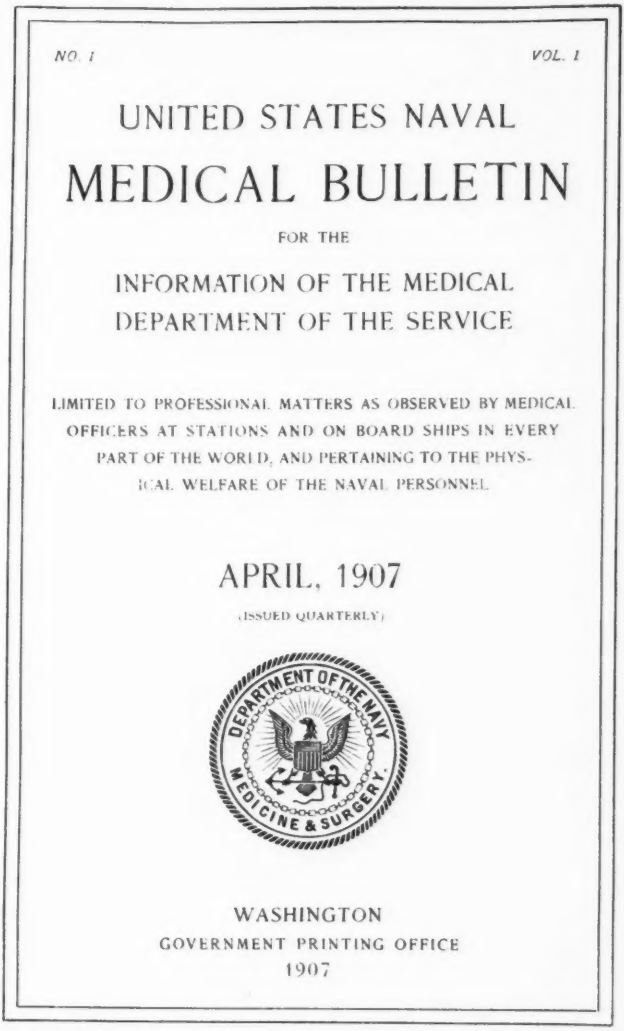
In Alaska an Air Force flight surgeon treated more than 100 Eskimos in a severe outbreak of diphtheria, and traced the spread of the disease from one village to another. The psychiatric reactions of troops to winter conditions in the arctic have been studied thoroughly. An alert Navy physician, in collaboration with a local medical practitioner, studied certain neurologic diseases on Guam and reported that amyotrophic lateral sclerosis is at least 100 times as prevalent on that island as in the United States and Canada. Another has called attention to an hitherto undescribed area in the American Samoa group where leprosy has occurred. A military ophthalmologist in Hawaii has compared the refractive errors found in oriental and Caucasian trainees. Army officers in Japan launched a group study to determine the type of person who resorts to self-inflicted gunshot wounds to escape combat. An Air Force psychiatrist made an extensive study of "the fear of flying syndrome" as observed in certain aircrew members.

In Germany, Army physicians had an opportunity to carry out research on viral hepatitis. Others have observed Q fever in French Morocco, yellow fever in Panama, and cancer in betel nut chewers in Siam. A military hospital commander in England drew a valuable lesson from a severe epidemic of poliomyelitis in Copenhagen where at the peak of the outbreak 50 patients a day were hospitalized.

Officers in military hospitals in the United States are continually seeking new methods of treatment and administration that will shorten the patient's convalescence and assure his prompt return to duty. Patients with fractures and those with duodenal ulcers are frequent subjects of such studies. A dentist at one Army post worked out a system that resulted in a 50-percent reduction in man-hours lost because of extensive dental treatment. Larger military medical centers have contributed notably to new medical knowledge in such important fields as frostbite, vascular surgery, use of antibiotics, treatment of tuberculosis, management of psychiatric patients in the combat zone, and the selection of men for hazardous duty. These are but a few of many significant examples of modern military medical practice.

It is the mission, as well as the good fortune, of the *United States Armed Forces Medical Journal* to have reported all of these experiences. Born in the 1949 era of unification, the *Journal* celebrated its fifth anniversary with the appearance of the issue for December 1954. Its worthy predecessors, the *Bulletin of the U. S. Army Medical Department* and the *U. S. Naval Medical Bulletin*, were suspended in December 1949, in favor of a joint professional publication representing the medical services of our three military departments.

Published without interruption for 42 years, the *U. S. Naval Medical Bulletin* first appeared in April 1907 (fig. 1) when Rear Admiral Presley M. Rixey was Surgeon General. In this first issue



NO. 1 VOL. 1

UNITED STATES NAVAL

MEDICAL BULLETIN

FOR THE

INFORMATION OF THE MEDICAL DEPARTMENT OF THE SERVICE

LIMITED TO PROFESSIONAL MATTERS AS OBSERVED BY MEDICAL OFFICERS AT STATIONS AND ON BOARD SHIPS IN EVERY PART OF THE WORLD, AND PERTAINING TO THE PHYSICAL WELFARE OF THE NAVAL PERSONNEL

APRIL, 1907

(ISSUED QUARTERLY)

DEPARTMENT OF THE NAVY
MEDICINE & SURGERY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

*Figure 1. The cover of the first issue of the* United States Naval Medical Bulletin, *which was published continuously from April 1907 through December 1949.*

he expressed the belief "that the corps as a whole should profit, to the good of the service, out of the experiences and observa-

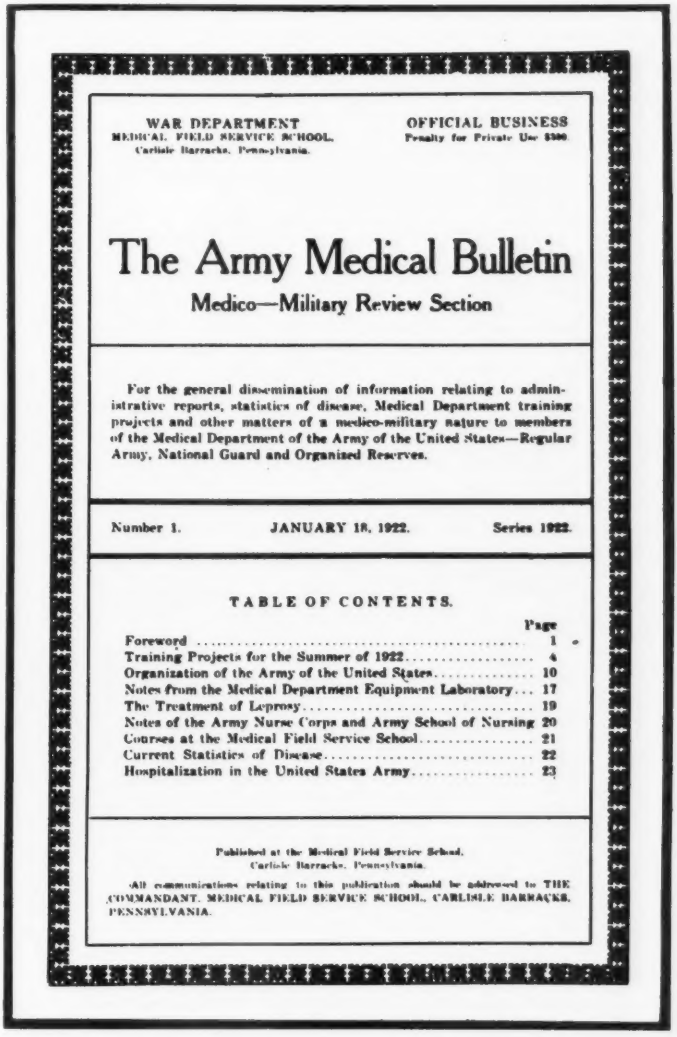
tions of the individual," and entrusted the editorship to Surgeon William H. Bell, (fig. 2) an able young officer who became a rear admiral before his retirement in 1935. This first issue of the naval *Bulletin* significantly contained a report from the Philippine Islands, "Dengue and Influenza in the Tropics; A Method of Differential Diagnosis," by another promising officer who became one of the Navy's outstanding Surgeons General 13 years later—

*Figure 2. Surgeon William H. Bell, USN, first editor of the* United States Naval Medical Bulletin; *he retired in 1935 with the rank of rear admiral.*

Surgeon Edward R. Stitt. To the end, the *U. S. Naval Medical Bulletin* faithfully performed its mission of publishing articles on "professional matters as observed by medical officers at stations and on board ships in every part of the world, and pertaining to the physical welfare of naval personnel."

First known as *The Army Medical Bulletin,* the *Journal's* other predecessor was inaugurated on 18 January 1922 (fig. 3) by Major General Merritte W. Ireland, Surgeon General of the Army, as a

quarterly periodical to succeed the *Medico-Military Review*, a mimeographed publication that had been issued twice monthly since December 1919.



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# The Army Medical Bulletin

## Medico—Military Review Section

For the general dissemination of information relating to administrative reports, statistics of disease, Medical Department training projects and other matters of a medico-military nature to members of the Medical Department of the Army of the United States—Regular Army, National Guard and Organized Reserves.

Number 1. JANUARY 18, 1922. Series 1922.

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Published at the Medical Field Service School,
Carlisle Barracks, Pennsylvania.

All communications relating to this publication should be addressed to THE COMMANDANT, MEDICAL FIELD SERVICE SCHOOL, CARLISLE BARRACKS, PENNSYLVANIA.

*Figure 3. Originally known as* The Army Medical Bulletin, *the* Bulletin of the U. S. Army Medical Department *first appeared on 18 January 1922. This is the cover of the initial issue.*

The first staff of editors included Major Guy B. Denit (fig. 4) who retired in 1953 as a major general. Somewhat administrative

in tone, the first issue contained an article on "Training Projects for the Summer of 1922," and notes on C. M. T. C. and R. O. T. C. activities and on the organization of the Army of the United States. With the issue for October 1943, the name was changed to the *Bulletin of the U. S. Army Medical Department.* It was subsequently published monthly under the editorship of Major Johnson F. Hammond, now associate editor of the *Journal of the American Medical Association.*

*Figure 4. Major Guy B. Denit, member of the first staff of editors of* The Army Medical Bulletin; *he retired in 1953 with the rank of major general.*

After study of the recommendations of several advisory committees, Secretary of Defense Forrestal on 22 March 1949 gave his approval to the general plan of establishing a joint Medical Publications Board to publish an "Armed Forces Medical Journal." Mr. Louis Johnson, his successor, in a memorandum to the secretaries of the military departments on 17 November 1949 directed the establishment of the Armed Forces Medical Publication Agen-

cy, and on the same date addressed a message to "the medical personnel of our Armed Forces" in which he stated:

> "The formation of the *United States Armed Forces Medical Journal* is a result of the consolidation of the *Bulletin of the U. S. Army Medical Department* and of the *U. S. Naval Medical Bulletin* and marks another "first" in the annals of the Armed Forces of our country. It emphasizes the close unity and cooperation which have always existed among the medical personnel of the Army, Navy, and Air Force. All of us are proud of their record and their epochal achievements in the past and I am certain that in the future, this medium will contain reports of accomplishments in military medicine of even greater significance to the health and welfare of the personnel of our Armed Forces and our Nation."

Under its own charter and joint regulations of the Army, Navy, and Air Force, the Armed Forces Medical Publication Agency publishes the *Journal* and its supplement, the *Medical Technicians Bulletin,* in accordance with general policies of Dr. Frank B. Berry, Assistant Secretary of Defense (Health and Medical). Its staff includes officers of the Medical Corps of the Army, Navy, and Air Force, one of whom is editor and the others associate editors. The position of editor is rotated every 2 years. The Agency's publications are printed by the U. S. Government Printing Office, and distribution is made by the three services in accordance with the recommendations of the Surgeons General.

The first editor of the *Journal* was a Navy officer, Captain Joseph L. Schwartz, now retired, who had been serving as editor of the *U. S. Naval Medical Bulletin* when it was suspended. Colonel Wayne G. Brandstadt, the last editor of the *Bulletin of the U. S. Army Medical Department* became the first Army editor of the *Journal* in July 1951. Also retired from the service, Colonel Brandstadt is now assistant editor of the *Journal of the American Medical Association.*

The worldwide circulation of the *U. S. Armed Forces Medical Journal* reached a high of nearly 40,000 copies per issue during the Korean war. For the past 3 years about 30,000 copies each month have been distributed. These figures do not include paid subscribers, who are served by the Superintendent of Documents. The *Journal* is received by all medical services officers on active duty and many reserve officers in private practice. It goes to all medical and dental school libraries in the United States and Canada, and to many in South America and Europe. It also is sent to nearly 200 editors of other medical journals in exchange for their publications.

In the 60 issues published in the past 5 years, the *Journal* has printed a total of 1,198 signed articles. Of these, 1,130, or 94 per-

cent were contributed by regular and reserve officers of the medical services. The remainder came from authors without military affiliations. The published reports have been informative, diverse, and often controversial. They cover professional, and frequently administrative aspects of the medical sciences; and include all of the clinical specialties, as well as an occasional historical note.

In its regular departments the *Journal* has brought its readers information and news of both military and medical interest. Broad coverage is given to new books and monographs in the medical sciences—a total of 1,313 reviews by qualified specialists have been published. Few monthly medical periodicals approach this average of more than 20 reviews of new books per issue. Since January 1955 the *Journal* has brought its readers each month the report of a clinicopathologic conference presented in one of the larger Army, Navy, or Air Force hospitals.

The *Journal* is a medium which enables authors to share their new professional knowledge with fellow officers and practitioners everywhere. In the years to come, it will continue to aid the military medical services in their mission of maintaining the health of our fighting forces.

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### GET THAT READER—AND HOLD HIM

As a constant reader and an occasional editor, I used to try conscientiously to plow through the mounds of impassable prose that reached my desk. But no more. I've made a decision that I suspect a good many other readers and editors will also make—if, indeed, they have not made it already. I've decided that if the writer won't say what he has to say in an interesting, clear, and simple fashion, I just won't read it. There are too many medical articles clamoring for the attention of us doctors, as it is. Scientific prose *needn't* be dismal. It *can* be made readable—even pleasantly so—if the writer will only work at the job. But he's got to make a real effort to capture the reader's attention and to hold it.

—HENRY A. DAVIDSON, M. D.
in *Medical Economics*,
p. 175, Jan. 1955

# THE ARMY AVIATION MEDICINE PROGRAM

SPURGEON H. NEEL, *Lieutenant Colonel, MC, USA*

THE NATIONAL Security Act of 1947, as amended in 1949, provides that, "In general the Army shall include land combat and service forces and such aviation and water transportation as may be organic therein." A series of subsequent agreements between the Secretaries of the Army and the Air Force have established that, generally, the Army may have such fixed-wing aircraft (not exceeding 5,000 pounds empty weight) as it requires to perform its organic missions, and rotary-wing aircraft (without weight limitations) as required for its logistic and tactical missions within the combat zone. As envisaged, Army aviation will be organic to the several existing branches of the service, and no separate "Corps of Army Aviation" will be established. Revolutionary tactical and logistical developments in recent years have necessitated a rapid expansion in Army aviation, both as to missions and the numbers and types of aircraft required.

Concurrently with this rapid expansion in Army aviation, there has been increasing emphasis on aviation medicine within the Army. The Army Medical Service has two primary fields of responsibility and interest in the Army aviation program. They are:

1. Technical responsibility for medical matters pertaining to the over-all Army aviation program, and

2. Over-all responsibility for all matters pertaining to the organization and utilization of Army Medical Service Aviation.

While these two basic fields of interest are closely related, emphasis in this article will be placed on the first, or technical responsibility of the Army Medical Service. The clinical aspects of forward air evacuation by Army Medical Service helicopters have been discussed in a previous article.[1]

## ARMY AVIATION

It is axiomatic that maximum exploitation of the full capabilities of Army aviation depends, to a considerable extent, on the proper selection and care of Army flyers. The immediate corollary is that responsible commanders, as well as individual flyers, must have sound, timely medical advice. This advice should come from Army medical officers, trained in aviation medicine and possessing a realistic knowledge of Army aviation and its specific problems.

From Office of The Surgeon General, Department of the Army, Washington, D. C.



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It is advantageous to examine some of the basic characteristics of Army aviation, particularly those affecting the Army Medical Service. Army aviation is organic, not only to the Army, but also to the several branches of the service and to the major tactical units in the field. Thus, Army aviators and medical problems are not concentrated in a few well-defined locations, but are dispersed throughout the entire combat zone. The Army Medical Service is confronted with the problem of caring for steadily increasing numbers of flying personnel, widely dispersed, and with a variety of missions.

The stresses of Army aviation are specific to a certain extent. Weight limitations and operational requirements preclude equipping Army aircraft with complex navigational aides, and, normally, copilots are not used. Thus the Army aviator must maintain continuous surveillance over the terrain, his aircraft, and such instruments as are provided. Further, in many cases, the pilot has other concurrent responsibilities such as caring for a patient, adjusting artillery fire, observing enemy activities, et cetera. The stress of this type of flying cannot be overly emphasized. The many missions of Army aviation and the fluidity and uncertainties of combat in forward areas require frequent flights in all sorts of weather, with very little rest or inactivity between sorties.

Even between flights, there is little abatement of stress. On completion of fatiguing missions, Army aviators are required to live under conditions comparable to those of front line infantry troops. They are rotated to quiet areas on a basis of completion of a relatively long fixed tour. This lack of complete relaxation between missions, and the presence of certain unavoidable deprivations, further increase the hazards of continued flying efficiency. Maintenance of efficiency despite these necessary undesirable factors requires an effective personnel management program, which, in turn, should be based on sound medical advice.

## ARMY AVIATION MEDICINE

Basically, the Army aviation medicine program includes the following:(1) Physical examinations for proper selection of flying applicants, and as a guide for their subsequent use as pilots; (2) clinical care of flying personnel, considering the specific problems inherent to such personnel; (3) a "care of the flyer" program to preserve maximum individual and unit efficiency; (4) advice to responsible commanders and boards of officers concerning medical aspects of aviation problems; and (5) development, with other responsible agencies, of improved policies and procedures for use of flying personnel, of aircraft, and of equipment.

The best-known function of aviation medicine is the performance of initial, periodic, and special physical examinations on

flying personnel. Army Regulation 40-110 prescribes in detail the standards and procedures for the medical examination for flying. These standards place increased emphasis on the psychologic, visual, and hearing standards. To be completely effective, examining officers require additional training in these important and specific fields, as well as experience with Army aviation. This latter requirement is particularly important in performing the so-called ARMA (Adaptability Rating for Military Aeronautics). The over-all psychologic evaluation of the aviation candidate cannot be overly emphasized. Air Force experience indicates that this selection should be made only by officers who are thoroughly familiar with the hazards and stresses incident to flying, and their potential effect on the examinee in question. It is not reasonable to expect an officer unfamiliar with Army aviation to adequately evaluate the flying applicant.

The continued stresses of Army aviation dictate that flying personnel receive annual medical evaluations which serve as a basis for individual recommendations to pilots examined, as well as improvement of the over-all Army aviation program. Personnel involved in aircraft accidents are required to have medical evaluation prior to returning to flying duty. Aviation medical officers should recommend detailed corrective action for all latent or manifest defects noted.

Wherever feasible, it is advantageous to have aviation medical officers treat flying personnel who require either outpatient or inpatient care. Experienced aviation medical officers are familiar with problems peculiar to Army aviators, as well as the effects of certain diseases and medications on flyers. Many diseases and treatment regimens require that a pilot be removed from flying duties temporarily. The common cold, a nuisance to anyone, is a matter of much graver concern to the pilot. The use of such drugs as the antihistaminics and the barbiturates requires that pilots do not fly during the period of effectiveness of the drug. The aviation medical officer should integrate his professional activities with those of the medical installation within which he functions. He should be charged with the care of nonflying as well as flying personnel, and his additional training should be exploited. Aviation medicine should not be isolated from the over-all medical effort of the command.

The "care of the flyer" program is preventive medicine exemplified. The truly effective aviation medical officer knows his pilots, performs their medical examinations, maintains essential medical records, and treats his patients. These are the fundamental elements of the "care of the flyer" program. Aviation medical officers should periodically visit air installations in the area serviced, and should fly with their charges to determine their individual

situations and problems. The recognition of incipient diseases and physical defects permits early preventive or corrective action prior to the time a pilot becomes disabled. The time spent by the aviation medical officer in "living" with his pilots pays large dividends in better medicine and better flying.

Commanders and boards of officers investigating aircraft accidents should receive sound realistic medical advice and opinion. While participation by medical officers on boards of investigation borders on so-called "administrative medicine," such participation is a must if corrective action is to be effective. Medical advisors to such boards should be well grounded in aviation medicine and reasonably familiar with Army aircraft and necessary administrative procedures. Aircraft accidents generate casualties, and must be minimized if the noneffective rate among Army aviators is to be reduced. Effective corrective action will also improve the safety and reliability of Army aviation.

The sound future development of the still infant Army aviation program requires full effective medical participation. The individual pilot should receive full consideration in the development of policies for his training and utilization. While it is impractical to develop so-called "military characteristics" for Army aviators, those best suited must be selected from resources available. Army medical officers, familiar with the physical and mental requirements for flying, can provide technical guidance which is so essential in the development of sound policies and procedures. In the development of aircraft the pilot, likewise, must receive full consideration. Equipment and instruments should be designed to minimize fatigue and enhance safety and reliability. Responsible engineering agencies should have access to sound professional medical guidance.

## THE AVIATION MEDICAL OFFICER

With the establishment of an autonomous Air Force, most qualified "flight surgeons" elected to remain with the U. S. Air Force. Initially, the Army relied completely on the support of these highly qualified and experienced men for the care of Army aviation personnel. An occasional Army medical officer was sent to the U. S. Air Force School of Aviation Medicine at Randolph Air Force Base, Tex. These officers normally returned to their former duty station and assignment and did not actively participate in the practice of aviation medicine. Experiences in Korea indicated the Army Medical Service's need for an active aviation medicine program.

In late 1953, The Surgeon General sent a group of junior Army medical officers to the U. S. Air Force School of Aviation Medicine to attend short courses of instruction, followed by brief peri-

ods of orientation at the Artillery Center, Fort Sill, Okla., then the site of Army aviation training. These officers were subsequently assigned to commands overseas and within the United States where they might perform duties related to the examination and care of flyers. Surgeons of major subordinate commands assigned these officers against existing vacancies and established the degree of effort to be devoted to the practice of aviation medicine.

In 1954, a revision to Special Regulations 605-105-5, "Commissioned and Warrant Officers Personnel Military Occupational Specialties," authorized the Military Occupational Specialty (MOS) number of 3160, representing the "Aviation Medical Officer." These officers "provide aviation and general medical service for Army aviation pilots and ground personnel in hospitals, dispensaries, field units, and other military installations." To qualify for this MOS, Army medical officers must be graduates of a course in aviation medicine and must be capable of performing the duties required. The aviation medical officer is the key to the success of the over-all Army aviation medicine program. In the field, he is responsible for the medical selection and care of Army aviators; at staff level, he provides necessary advice concerning their development and utilization. His duties are prescribed in Army SR 605-105-5.

The Army aviation medical officer must be a well-rounded physician with additional training and responsibilities in aviation medicine. As Army aviation is organic to the existing branches of the service, the aviation medical officer is an integral part of the Army Medical Service. His responsibilities toward nonaviation medicine enhances rather than reduces his effectiveness in the practice of Army aviation medicine.

## TECHNICAL GUIDANCE

There are two primary facets to the implementation of the Army aviation medicine program. Centralized technical guidance is necessary for efficiency and standardization. An effective field organization is required for soundness and realistic support. The Army has accepted the proven soundness of Air Force medical doctrine and procedure, and has adapted them to actual requirements of the Army. Department of the Army Technical Bulletin (TB Med 236), Medical Army Aviation Medicine dated 2 March 1955 contains the basic technical information required by aviation medical officers in the field.

## ORGANIZATION FOR ARMY AVIATION MEDICINE

Although the MOS 3160, "Aviation Medical Officer," is authorized, and selected Army medical officers are being trained in aviation medicine, there is still no established organization for

their use in the field. As available, aviation medical officers are being assigned against requirements from major commands. No Table of Organization and Equipment (T/O&E) or table of distribution contains this MOS, and requisitions are submitted against vacancies in other Medical Corps MOS's. Surgeons of major commands are permitted considerable freedom in the assignment and use of these officers. Available information is that aviation medical officers are being used in general medical duties, devoting varying periods of their time to the practice of aviation medicine. While this may reflect the existing shortage of medical officers, it indicates the desirability of integrating aviation medicine with the over-all medical effort of the command.

In late 1954, major commanders were requested to study the problem of assignment and utilization of aviation medical officers, and to submit specific recommendations by July 1955. Based on these recommendations, basic T/O&E's and tables of distribution will be evaluated with the view toward incorporating spaces for aviation medical officers. From information received to date it seems that few additional Medical Corps spaces will be required. It is more likely that aviation medical officers will be substituted for appropriate existing positions, primarily "Medical Officers, General Duty" (MOS 3100), and will be charged with the care of nonflying as well as flying personnel.

Pending completion of this evaluation, aviation medical officers are being assigned as they become available. At present, the basis of assignment is: One medical officer per division (airborne, armored and infantry), one per corps and army headquarters, and one per 30 pilots on an area basis. Those assigned to major command headquarters will have a dual function. They will care for assigned and attached flying personnel and will also assist the surgeon in the review of medical examinations and related administrative procedures. Experience has indicated that these medical officers can and should function in existing medical installations.

At posts located within the continental United States it is believed that aviation medicine should be included within the functions of the post surgeon. While divisional size units should have assigned aviation medical officers in connection with their readiness mission, assignment of medical officers to separate aviation units and activities is not considered the most economical use of such officers. A more equitable procedure is the identification of appropriate spaces in the medical portion of tables of distribution to ensure adequate aviation medical support on a post basis and under the supervision of the post surgeon. While aviation medical officers will require additional technical and administrative assistance, no requirement is presently fore-

seen for the establishment of a special enlisted specialty in support of the program.

One overseas theater has submitted a recommendation that a cellular aviation medicine team be included in T/O&E 8-500 for aviation medicine support on an attached or area basis. This recommendation is being held in abeyance pending completion of the major study mentioned. Within the United States, required medical examinations for flying are being accomplished at medical installations which have been designated by major command surgeons and approved by The Surgeon General. Specialized equipment required is contained in the U. S. Air Force Flight Surgeon's kit which will probably be standardized for use within the Army in the very near future. Pending this action, individual items of additional equipment are being issued on the basis of justification for the aviation medicine mission.

## WINGS AND PAY

It is inevitable that problems related to the authorization of distinctive insignia and additional flying pay for aviation medical officers will have to be resolved. Both incentives have proved necessary in the U. S. Air Force. The Surgeon General is giving careful thought to these problems.

Of these two incentives, the authorization of distinctive wings appears to be the more immediately important. The identification that is so important to any practice of medicine dictates that aviation medical officers wear wings denoting their status. From custom and long experience, flying personnel have come to expect their physicians to wear wings. Accordingly, The Surgeon General has recently submitted a recommendation that a distinctive insignia be developed and authorized for aviation medical officers. Approval of this recommendation has been deferred pending final action of the Army Uniform Board. If approved, the insignia will probably be the Army Aviator's Badge with caduceus superimposed.

The problem of flying pay for aviation medical officers is a more difficult one. While it is Department of the Army policy that men required to participate regularly in frequent aerial flights as a part of their official duties should be authorized additional flying pay, careful consideration must be given as to who should be entitled to such pay and when. Presently, the subject of flying pay for aviation medical officers is resolved by major commanders with wide variations in policy. As a builder of morale, additional pay is a double-edged sword. An example can be found in the infantry division. Battalion surgeons may well resent a medical officer normally working in the divisional rear area who receives additional hazardous duty pay. Another example is in the career

pattern of aviation medical officers themselves. Those men in staff positions at higher headquarters who are best qualified by training and experience but not actually required to fly to the extent of those located at lower echelons will resent the deprivation of flying pay incident to their advancement to positions of greater responsibility.

Personally, I would recommend that an aviation medical officer's wings be awarded on a basis of training and experience, with designation by The Surgeon General. By contrast, I would recommend that additional flying pay be authorized on a basis of actual duties performed, with the decision resting with the major commander concerned. This will ensure consonance with current budgetary policies. The MOS 3160 "Aviation Medical Officer" should be granted to medical officers completing the course of instruction at the U. S. Air Force School of Aviation Medicine, which is the present procedure. Authorization to wear the distinctive wings (when approved) should be withheld until the aviation medical officer has accrued certain additional experience, to include a period of duty in aviation medicine, accumulation of a prescribed number of flying hours, the performance of an established number of medical examinations for flying, and the recommendation of a responsible senior Army aviation medical officer.

## CONCLUSIONS

There is a requirement for an Army aviation medicine program. The Surgeon General has established such a program and is developing it commensurate with actual needs in the field. Technical guidance, based on the adaptation of accepted Air Force medical doctrine to actual Army requirements, is considered adequate and is reflected in a medical technical bulletin. The current primary objective of the Army aviation medicine program is the development of an effective organization for its implementation in the field. Full use will be made of established Air Force aviation medicine training facilities and Army medical specialists in existing Army medical installations. Aviation medical officers should be authorized distinctive insignia on completion of certain qualifying experience and on designation by The Surgeon General. Additional flying pay for Army aviation medical officers should be contingent upon actual duties performed and should be the prerogative of major commanders in the field. The Army Medical Service must keep pace with the rapidly growing Army aviation program.

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# Clinicopathologic Conference

Letterman Army Hospital, San Francisco, Calif.*

## COUGH, DYSPNEA, AND CHEST PAIN

**Summary of Clinical History.** A 59-year-old white woman was admitted to this hospital on 19 May 1954 with a cough productive of purulent material, shortness of breath, and weight loss. The patient had been in rather poor health since the onset of arthritis some 10 years ago. She first developed symptoms referable to the chest in 1952 when she had a cough which lasted several months. Two weeks before admission she developed a severe, racking cough productive of from 50 to 60 ml. of purulent material. This was associated with an aching pain throughout the chest which was aggravated by the act of coughing. During this time she had become progressively short of breath, but she denied any hemoptysis. Over the past 10 years she had lost 55 pounds in weight and during the past 2 weeks she had lost 5 pounds.

A diagnosis of rheumatoid arthritis had been made 10 years ago. The arthritis began in the feet (metatarsophalangeal joints of great toes), involved the metacarpophalangeal joints of the fingers some months later, and eventually involved every joint of the extremities and spine to a slight degree with residual deformity of the joints. She had taken many types of antiarthritis medications, the nature of which is not known. At the time of admission the arthritis appeared to be inactive. Previous operations included a tonsillectomy at the age of 25, panhysterectomy for "bleeding tumor" at the age of 40, and full-mouth extractions at the age of 47. She gave no history of rheumatic fever, syphilis, renal disease, or liver disease. She was a known hypertensive of unknown duration. The family history was noncontributory.

**Physical Examination.** The patient's height was 62 in.; her average weight, 138 lb.; present weight, 81½ lb.; temperature, 99° F.; pulse, 72; and blood pressure, 172/78 mm. Hg. She was

*Brig. Gen. James O. Gillespie, MC, USA, Commanding Officer. From the Medical Service, Col. Wilbur H. Berry, MC, USA, Chief.

a thin, malnourished appearing Spanish woman in moderate respiratory distress, with a frequent cough productive of a green, purulent sputum. Her movements were slow because of joint distress and general weakness. Her eyes appeared sunken. The left cornea was considered to be either abraded or to contain edema fluid, in that it was irregularly refractile. The retinal vessels demonstrated narrowing of the arterioles with mild A-V nicking. There was a 1-cm., hard, excoriated lesion of the helix of the left ear. An excoriated area was present on the left side of the nasal septum. Diffuse inspiratory rales were heard throughout the lung fields, but most prominent on the right side. The cardiac rate was regular. No murmurs were heard. The point of maximal impulse was 2 cm. lateral to the midclavicular line in the left fifth interspace and was forceful.

The firm, smooth liver border was 3 cm. below the right costal margin. The spleen was easily palpable one fingerbreadth below the left costal margin and was firm. Pelvic examination was negative. On rectal examination there appeared to be a large quantity of yellow-green, foul, liquid feces, and mucus. The left costovertebral angle was tender. The hands, elbows, shoulders, knees, ankles, and feet showed deforming arthritic involvement. The metatarsophalangeal joints of the great toes had large, red, tender swellings with atrophic skin overlying them. All of the muscles appeared atrophic, and the skin was generally dry and scaly with poor tissue turgor. Slight presacral edema and moderate pretibial edema were present. There was a 2- by 4-cm., freely movable node in the right axilla. The remainder of the examination did not reveal any significant abnormality.

**Laboratory Studies.** Initial laboratory studies were as follows: Erythrocyte count, 3.9 million per cu. mm.; hemoglobin, 7.3 grams per 100 ml.; leukocyte count, 15,300 per cu. mm., with 78 percent neutrophils, 13 percent lymphocytes, 3 percent monocytes, and 6 percent eosinophils. Urinalysis showed a specific gravity of 1.010, 4 plus albumin, 3 to 4 red blood cells, and a few bacteria. The serologic test was negative. The blood uric acid was 8.2 mg. per 100 ml.; $CO_2$, 14.2 mEq/L; chloride, 114 mEq/L; calcium, 8.2 mg. per 100 ml.; alkaline phosphatase, 6.6 units (Shinowara, Jones, and Reinhart method); and potassium, 5.6 mEq/L. On 21 May the blood urea nitrogen was 64 mg. per 100 ml.; the total protein 9.2 (albumin 5.4, globulin 3.8) gm. per 100 ml. Acid-fast studies of the sputum were negative, as were the Papanicolaou smears. Sputum culture showed beta hemolytic streptococci, alpha hemolytic streptococci, and *Micrococcus pyogenes* var. *aureus*. Culture of a rectal swab showed *Escherichia coli*. Repeat urinalysis showed 3 to 4 plus albuminuria with a specific gravity as high as 1.025. On only one specimen were rare, coarse,

granular casts observed. Examination of a stool specimen was negative for ova and parasites. A roentgenogram of the chest showed increased lung markings throughout both lungs, suggesting generalized pulmonary fibrosis. There was blunting of the right costophrenic sulcus and some thickening along the right lateral chest wall, suggestive of an old inflammatory disease. Roentgenograms of both hands showed advanced arthritic changes involving many joints.

**Course in Hospital.** When the patient was initially admitted it was not known whether the pulmonary findings were due to primary pulmonary disease or were secondary to congestive failure. The venous pressure was 140 mm. of water with arm to tongue circulation time of 11 seconds. She was digitalized and given thiomerin (brand of mercaptomerin sodium) with loss of 3½ lb. of body weight in 1 day. She was started on penicillin and streptomycin. Her pulmonary symptoms seemed to clear 2 days after admission but her general course continued downhill. She had retention of nitrogenous products with a nonprotein nitrogen as high as 147 mg. per 100 ml. Along with this, her $CO_2$ combining power fell to 10.8 volumes percent and the potassium rose to 8.2 mEq/L. Because of the anemia she was given 500 ml. of whole blood which restored her hemoglobin level to 11.8 gm. per 100 ml. In spite of all the therapeutic measures she continued her downhill course and died quietly at 2320 hours on 24 May.

## DISCUSSION

**Doctor Gibson:*** This 59-year-old white woman with emaciation, marked weight loss, and chronic illness had had crippling, deforming arthritis ultimately involving every joint of the extremities and spine. Several features indicated respiratory tract involvement. There had been a chronic cough of several months' duration some 2 years previously and a severe, productive cough for 2 weeks prior to this hospital admission. A chest roentgenogram revealed increased lung markings throughout both lung fields. She was dyspneic and had diffuse inspiratory rales. The liver and spleen were enlarged and firm. Diarrhea was implied since rectal examination revealed large quantities of liquid feces. Pretibial and presacral edema were present. Involvement of the hematopoietic system was manifested by anemia, leukocytosis, neutrophilia, and eosinophilia. Finally, the marked albuminuria, uremia, acidosis, hyperpotassemia, and hyperuricemia denoted the presence of renal lesions. May we see the x-rays, Doctor Wells?

**Doctor Wells.**** Films of the wrists and hands (fig. 1) show very extensive destructive changes involving all of the joints of the wrist and most of the joints of the fingers. It is a destructive type of ar-

*Maj. John R. Gibson, MC, USA, Resident in Internal Medicine.
**Col. Paul O. Wells, MC, USA, Assistant Chief, Radiologic Section.

thritis with narrowing of the joints and subluxation of some joints. Some joints show ankylosis. There is associated atrophy of the soft tissue. These are the changes seen in rheumatoid arthritis. The lung fields bilaterally (fig. 2) show emphysema more or less evenly distributed. There is an increase in the bronchovascular markings which are nonspecific in appearance. There is some thickening of the pleura which would indicate old or possibly a recent inflammatory process in the pleura. The markings in the lung fields are nonspecific and are on the basis of fibrosis or peribronchial infiltration which is limited to the larger subdivisions of the bronchial tree. The heart is not enlarged; there is some enlargement of the aorta. There are no definite hilar nodes visible. In the feet there are extensive changes in the joints which are also consistent with the diagnosis of rheumatoid arthritis.

**Doctor Gibson:** I shall not discuss each of the diseases that may involve each of the organs and systems implicated in this patient. My remarks will be restricted to the few diseases which could cause all or most of these protean manifestations.

I believe that the arthritis is the key to this case. I am intrigued by the hard, excoriated lesion of the helix of the ear, the onset of the arthritis in the metatarsophalangeal joints of the great toes, the hyperuricemia, and the evidence of renal disease. Hench and associates[1] of the Mayo Clinic have said that chronic arthritis associated with distinct renal impairment suggests gout until proved otherwise. The majority of gouty patients die of uremia, and the age at onset in this patient is quite compatible with the diagnosis of gout. I can only speculate that the lesion of the helix of the ear was a tophus. The location and description are entirely compatible. I regret that the lesion was not needled and an attempt made to demonstrate monosodium urate crystals by the murexide test. I may similarly speculate that the excoriated area on the left side of the nasal septum overlaid another tophus—a not unusual site.

But there are several objections to the diagnosis of gout. Only about 5 percent of gouty subjects are females. A positive family history is present in 50 percent of females with gout. Wolfson and associates[2] have stated that tophaceous gout in women begins before the menopause; it clearly did not in this case. The hyperuricemia could well be explained on the basis of renal failure. I might mention in passing that the uric acid level in normal and gouty females is lower than that in their male counterparts, and many authorities consider a serum uric acid level of 5 mg. per 100 ml. in a female as significant as one of 6 mg. per 100 ml. in a male. Chronic gouty arthritis can be deforming and crippling, but the spine, shoulders, and hips are rarely involved in gout. There are no features suggestive of gout on the x-rays we have available. Another considerable objection is that gout does not explain the pulmonary findings, hepatosplenomegaly, marked weight loss,

*Figure 1. Roentgenogram of hands and wrists showing destructive changes involving all of the joints of the wrists and most of the joints of the fingers.*

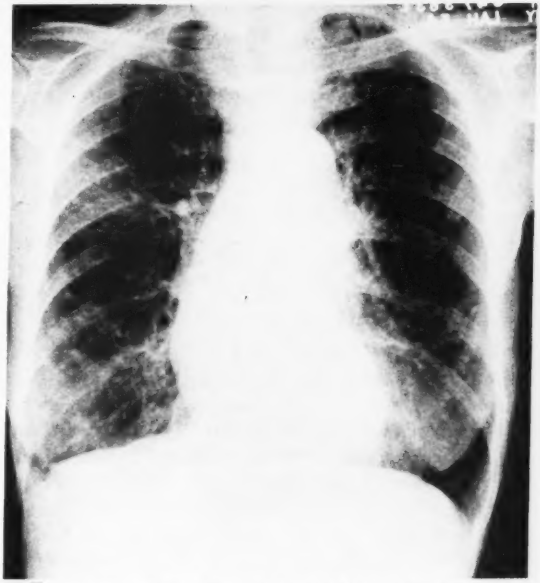

*Figure 2. Roentgenogram of lung fields showing emphysema and increased bronchovascular markings.*

anemia, or eosinophilia. Two or more unrelated diagnoses would be required to cover the remainder of the clinical picture.

I shall digress briefly from the arthritis to some of the generalized diseases which must receive consideration. Periarteritis nodosa can present many features found in this case. I shall discuss only the objections to the diagnosis. The ratio of male to female patients is four to one, and the usual age at onset is from 20 to 40 years. In this patient there was no peripheral neuritis, muscle tenderness, asthma, significant hypertension, or history of drug sensitivity. None of the foregoing are indispensable, but in the aggregate their absence mitigates against the diagnosis.

Many of the manifestations could be seen in sarcoidosis, but this diagnosis fails to explain the chronic, deforming arthritis or the renal failure.

Multiple myeloma must also be rejected since the small joints of the extremities are not involved in this disease.

Disseminated tuberculosis with its protean manifestations is always a possibility. This diagnosis cannot be established with the information available; neither can it be excluded.

Lupus erythematosus disseminata could explain the pleuritis, splenomegaly, lymphadenopathy, weight loss, fever, dyspnea, edema, diarrhea, albuminuria, and renal failure. Joint symptoms are common. Frequently there are tenderness and swelling of several joints, and rarely there are joint deformities indistinguishable from those of rheumatoid arthritis. Females are predominantly afflicted. Among the points against this diagnosis are the negative serologic findings, the age of the patient, the duration of illness, and the absence of a skin rash, leukopenia, and neurologic abnormalities.

I believe the most likely cause of the joint manifestations is rheumatoid arthritis in spite of the features suggestive of gouty arthritis. I cannot exclude the possibility of the rare coexistence of these two diseases. Rheumatoid arthritis is more common in females and in the chronic stage is often associated with marked joint deformity. Splenomegaly is seen. The corneal lesion may be a part of the picture of Sjögren's disease in which there may be seen punctate lesions of the cornea, dry skin, and rheumatoid arthritis. It is most common between the ages of 40 and 65 years. The eosinophilia is compatible with rheumatoid arthritis, as are the marked weight loss and moderate anemia. One of the most attractive features of this diagnosis is that rheumatoid arthritis is a recognized predisposing cause for the disease which I believe can explain all of the nonarticular manifestations in this patient. The occurrence of a firm, nontender, enlarged liver and spleen together with albuminuria in a patient with one of the predisposing diseases renders the diagnosis of amyloidosis almost certain. Chronic wasting diseases, particularly tuberculosis, are the most common pre-

disposing diseases. In numerous instances rheumatoid arthritis has been implicated.[3,4]

I believe that all of this patient's manifestations can be explained by chronic rheumatoid arthritis with secondary systemic amyloidosis and a terminal pyogenic respiratory infection. Secondary systemic amyloidosis commonly is manifested by marked weight loss, emaciation, albuminuria, renal failure, diarrhea, anemia, and firm, nonpainful, nontender hepatosplenomegaly. Edema of all degrees of severity is common. And I believe that this diagnosis can also explain the roentgenographic picture interpreted as generalized pulmonary fibrosis. Amyloid in the lung accumulates primarily in and about capillaries and small blood vessels. This can give a picture identical with that seen in this patient. Finally, I am unable to explain the serum proteins in this case. The elevated albumin and normal globulin are not compatible with my diagnoses.

**Dr. Gibson's diagnoses:**

1. Rheumatoid arthritis
2. Secondary systemic amyloidosis
3. Terminal respiratory infection

**Doctor Bayliss:*** Diagnoses submitted by the audience are as follows: rheumatoid arthritis with secondary amyloidosis, glomerulonephritis, periarteritis nodosa, allergic pneumonitis, and lung abscess. Would you comment on these diagnoses, especially the glomerulonephritis?

**Doctor Gibson:** Glomerulonephritis, allergic pneumonitis, and lung abscess would explain only a small portion of the clinical picture. The other diagnoses have already been discussed in my differential.

**Doctor Inmon:**** What additional information would you have liked to have had?

**Doctor Gibson:** Certainly a Congo red test would have been very helpful. One would expect that in amyloidosis of this severity the Congo red test would have been almost certainly positive. If more than 90 percent of the dye is removed from the blood stream at the end of 1 hour, the test is considered positive and diagnostic. The Congo red is taken up by the amyloid which is known to be a protein. Virchow named this material "amyloid" because it stained brown with iodine, and he therefore presumed it was a starch.

**Doctor Inmon:** What about liver biopsy as a diagnostic procedure?

**Doctor Gibson:** I have no personal experience. It is said to be valuable in secondary, systemic amyloidosis in which the liver is usually involved. It would probably not be of value in primary amyloidosis in which the involvement is characteristically of the tongue, heart, and gastrointestinal tract.

*Col. Milward W. Bayliss, MC, USA, Chief, Laboratory Service.

**Lt. Col. Thomas Inmon, MC, USA, Assistant Chief, Cardiology Service.

**Doctor Amory:*** What is the frequency of gout?

**Doctor Gibson:** The generally accepted figure is that gouty arthritis comprises 5 percent of arthritides.

**Doctor Tulin:**** The use of the Congo red test is attended with severe reactions, especially when it is repeated. There are occasional deaths.

## PATHOLOGIC FINDINGS

**Doctor Fadell:***** Grossly the kidneys showed reduction in size and irregular thinness of the cortices. Slight prominence and stiffness of the arteries on cut section was evident. The surfaces were finely granular. The liver showed a markedly accentuated pattern manifested by gray-tan markings which seemed to follow lobular outlines. It weighed 1,450 grams, which is considered normal. The spleen showed poor distinction between red and white pulp. It was moderately firm and weighed 310 grams.

Microscopic examination of the kidney (fig. 3) showed hyalinized acidophilic material within almost every glomerulus. In general, the material appeared to be diffuse. However, a tendency toward spherical arrangement was present. The afferent and efferent arterioles (fig. 4) showed deposition of this acidophilic material within their walls. Utilization of the crystal violet stain showed positive staining for amyloid. In the kidney in amyloidosis, the glomeruli are almost always involved and sometimes are the exclusive site of the deposition. This results in great enlargement of the glomeruli, although ultimately they may shrink. The amyloid appears to be laid down in the basement membranes of the capillary loops. Parenchymal reaction to amyloid is minimal. If the process lasts long enough, the final result is complete fibrosis of the glomerulus. Generally, the afferent arterioles show the greatest involvement and the efferent arterioles are involved only in advanced cases. The kidney tubules showed hyaline droplet degeneration. Many pathologists believe that this represents antecedent albuminuria.[5]

Microscopic examination of the spleen showed here, also, deposition of amyloid within trabecular, central, and penicillate arteries (fig. 5). In some cases the amyloid is deposited diffusely throughout the spleen.

The adrenal glands showed amyloid deposition throughout.

The liver (fig. 6) showed deposition of amyloid within the portal blood vessels. Generally, the amyloid material is deposited between the endothelial cells and the liver cords. In this case, however, the distribution is somewhat unusual and resembles that seen in primary amyloidosis, in that the deposit is most marked in the larger portal blood vessels. Also, it is unusual in that the liver was not enlarged.

*Col. Harold I. Amory, MC, USA, Chief, Radiologic Service.
**Maj. Maurice Tulin, MC, USA, Research Co-ordinator.
***Maj. Edward J. Fadell, MC, USA, Resident in Pathology.

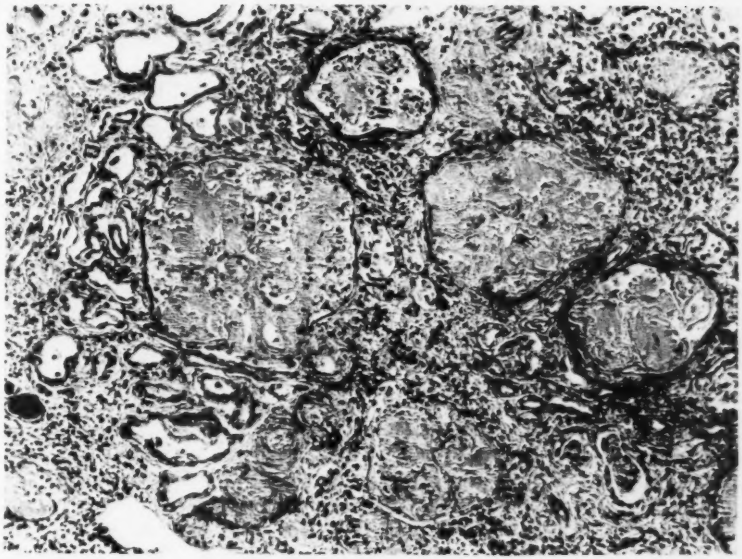

*Figure 3. Photomicrograph showing amyloid deposition within the glomeruli of the kidney.*

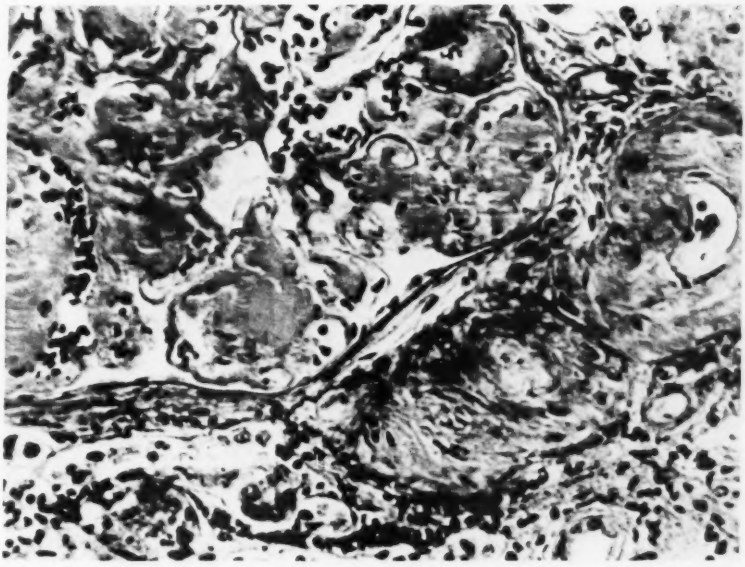

*Figure 4. Photomicrograph showing amyloid deposition in the walls of arterioles of the kidney.*

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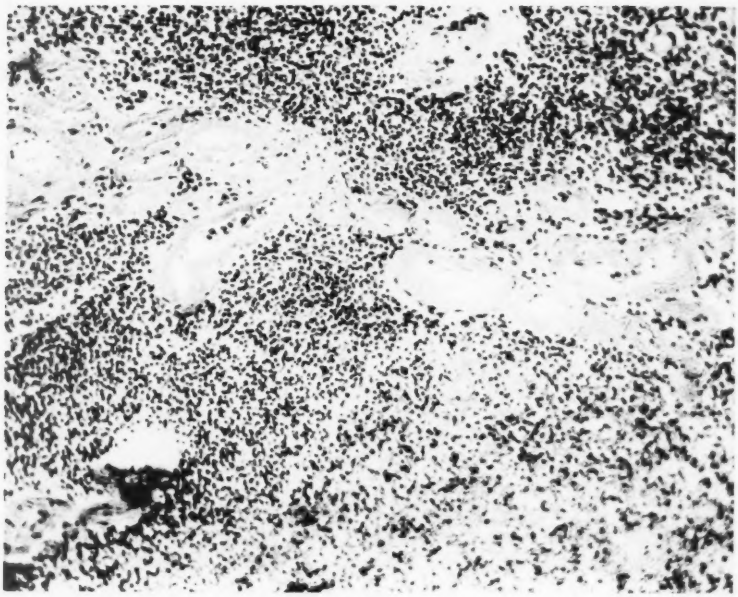

*Figure 5. Photomicrograph showing amyloid deposition in vascular walls of the spleen*

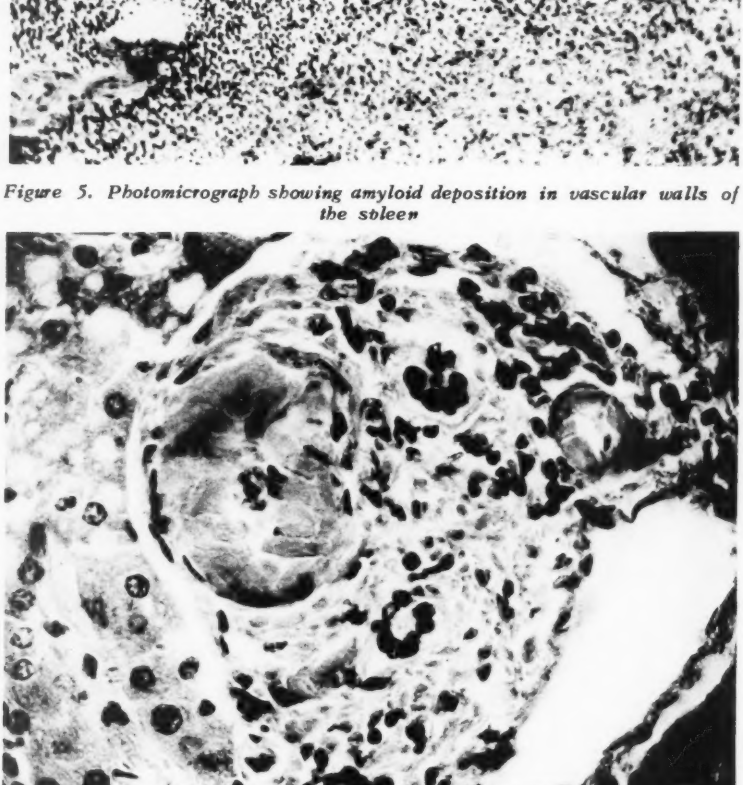

*Figure 6. Photomicrograph showing amyloid deposition in the walls of the portal blood vessels of the liver.*

Generally, amyloid deposition results in enlargement of the liver to a considerable degree. Biopsy of the liver is an ideal method of proving the presence of amyloidosis.[6] This measure should be considered when the possibility of amyloidosis arises clinically.

The lung showed, about the bronchi, numerous subepithelial chronic inflammatory cells associated with a rather pronounced degree of hyperemia. The diagnosis of "chronic bronchitis" was made. Pulmonary fibrosis or pneumonitis was not present at autopsy. The pituitary gland showed changes like those described by Pearse[7,8] in rheumatoid arthritis. Enlarged basophils were present with rather large granules restricted to one part of the cell. The significance of this lesion is unknown. Sections taken from the joints for microscopic study showed the changes of chronic rheumatoid arthritis consisting of slight chronic inflammatory cell infiltration and fibrosis of synovia together with some fragmentation of cartilage. There was one zone of pannus formation.

In summary, this case is one of secondary amyloidosis with amyloid deposition in the kidneys, liver, spleen, and adrenals predominantly. The cause of death was renal failure secondary to the amyloid contracted kidney. The most logical explanation for the cause of the amyloid change is the described rheumatoid arthritis. Amyloid deposition in the absence of suppuration has been described in this disease.[3] Renal insufficiency with consequent nitrogen retention and uremia occurs in unusual instances of the amyloid contracted kidney.

**Anatomic diagnoses:**

1. Secondary amyloidosis with renal insufficiency
2. Rheumatoid arthritis

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# CASE REPORTS

## Epigastric Hernia Simulating Gastrointestinal Tract Disease

FRANCIS P. CATANZARO, *Captain, USAF (MC)*

EPIGASTRIC hernia, or hernia through the linea alba, is said by Watson[1] to account for about one percent of all hernias. In the armed services, however, this hernia seems to be more frequent than statistics indicate. A majority of patients with this variety of hernia are asymptomatic and unaware of its existence, and diagnosis depends on careful physical examination.

At this hospital during the past three years 12 epigastric hernias have been repaired. During this same period a total of 96 patients with hernias of all types underwent operative procedures at this installation. Although these figures are not large enough to be significant statistically, they give some indication of the frequency of epigastric hernia and should serve to alert the examiner to its possible presence, particularly in patients with gastrointestinal symptoms. During the past year three patients gave histories suggestive of upper gastrointestinal tract disease, and on physical examination were found to have epigastric hernia. These hernias were repaired, resulting in complete relief of symptoms in each instance.

### CASE REPORTS

Case 1. A 40-year-old airman was admitted to the hospital on 26 April 1955 for a bilateral high ligation and stripping of the long saphenous veins. He stated that for the past 3 or 4 years he had been having repeated episodes of epigastric pain and bloating shortly after meals, with occasional episodes of vomiting, and that he frequently experienced a burning sensation in the upper abdomen. Roentgenograms of the upper gastrointestinal tract had been made at another installation about 2 years previously and these were reported to be negative.

On physical examination a small epigastric hernia was found about 2 cm. above the umbilicus, to the left of the median line. The hernia was about 1.2 cm. in diameter and was not reducible.

Under local anesthesia, a small transverse incision was made over the hernia, which was found to contain preperitoneal fat of the falciform ligament. The hernial ring was about 1 cm. in diameter. The fat was

From U. S. Air Force Hospital, Lake Charles Air Force Base, La.

amputated and the hernial orifice closed with interrupted 000 cotton sutures. The skin was closed with inverted mattress sutures, using 0000 cotton. The patient was followed postoperatively for 3 months, at the end of which period he was asymptomatic, eating well, and gaining weight.

Case 2. This 32-year-old airman had a similar history of epigastric pain and discomfort following meals, with occasional bouts of nausea but no vomiting. He denied episodes of hematemesis, melena, weight loss, or relief of pain by ingestion of food. While being followed in the outpatient department, an upper gastrointestinal series was done and recorded as negative.

On physical examination he was found to have a small epigastric hernia to the left of the median line, about 3 cm. from the umbilicus. This hernia was about 1 cm. in diameter and was moderately tender to palpation.

The patient was admitted to the hospital and the hernia repaired under local anesthesia, using the same surgical procedure as described in case 1. The patient has been followed for 6 months and has gained 6 pounds. He has not experienced recurrence of his upper gastrointestinal tract symptoms to date.

Case 3. This 23-year-old airman, while at work in the radiology department at this hospital, suddenly experienced severe epigastric pain radiating down to the right lower quadrant and producing extreme weakness and nausea. On examination his blood pressure and pulse were within normal limits. The abdomen was soft and a small epigastric hernia was found 1 cm. above the umbilicus in the median line. It was extremely tender to palpation, about 1.2 cm. in diameter, and irreducible. The following morning the patient was taken to the operating room and, under local anesthesia, a small transverse incision was made over the hernia. A small portion of preperitoneal fat was noted to protrude through a fascial ring, measuring about 8 mm. in diameter. With gentle tugging on the preperitoneal fat, the patient complained of severe epigastric pain radiating down to the right lower quadrant and reproducing his symptoms of the morning before. The preperitoneal fat was amputated, the hernial ring closed with interrupted 000 cotton sutures, and the skin approximated with interrupted 0000 cotton sutures. The patient returned to work the following day. He was followed for 10 months, during which time he had no recurrence of epigastric pain or discomfort.

## DISCUSSION

Epigastric hernia is usually located above the umbilicus, to the left of the median line. Less frequently it is found in the center or just to the right of the median line. It is extremely small and its fascial ring commonly measures only 1 to 1.5 cm. in diameter. A sac is rarely found. The hernial opening may contain falciform ligament, preperitoneal fat, omentum, or, occasion-

ally, intestinal viscera. About 75 percent of the patients with epigastric hernia will have no symptoms whatsoever, and diagnosis will depend on a careful physical examination. A small group will present subjective symptoms referable to the upper gastrointestinal tract; these symptoms may mimic the ulcer syndrome. There are frequent comments in the literature concerning the association of epigastric hernia with gastric ulcer. Watson reported that 25 percent of epigastric hernias with symptoms show changes in the gastric juice, and Allesandrini[2] reported that several cases demonstrated hyperacidity, lessened mobility, and dilation of the stomach. It is possible to theorize from these findings that the increase in gastric acidity in epigastric hernia may predispose to the formation of gastric or duodenal ulcer. However, the actual coexistence of ulcer and epigastric hernia is rare, and the gastrointestinal symptoms most likely can be explained on the basis of a dragging or pulling of the umbilical ligament or omentum which is protruding through the hernial orifice. Actual incarceration or strangulation is unusual and not reported with any significant frequency in the literature. Three of the patients observed here during the past year presented marked gastrointestinal symptoms as a chief complaint. One other patient had no symptoms whatsoever, but at the time of operation the hernia was found to have two openings through the fascia. Multiple openings are not found frequently but should be looked for in every instance.

## SUMMARY

Three patients with epigastric hernia had marked upper gastrointestinal symptoms that disappeared after a minor surgical procedure. This article has been presented to renew interest in an often overlooked surgical entity, and to stress its frequent association with the symptoms of upper gastrointestinal tract disease.

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*Knowledge is a process of piling up facts; wisdom lies in their simplification.*—Martin T. Fischer

# Severe Neurocirculatory Collapse at Simulated Altitude

MANAH R. HALBOUTY, *Colonel, USAF (MC)*

JOHN J. HEISLER, *Captain, USAF (MC)*

NEUROCIRCULATORY collapse at either true or simulated altitudes is not uncommon. Apparently, many of the severe cases are not reported in current medical literature. The greatest number of known cases that do occur are found in physiological training units where personnel are subjected to simulated altitudes. Most of these patients survive because of the close scrutiny provided during altitude chamber runs and the ready and immediate medical care available to the physiological training units.

When a case of neurocirculatory collapse occurs in actual flight the patient often does not survive unless early adequate medical care is provided. Unavoidably, at times, such care is several or many hours away. In most cases, early medical care will prevent the patient from going from slight or moderate collapse into deeper irreversible collapse.

It is considered essential that all Air Force physicians (not only Aviation Medical Examiners and flight surgeons) and all flying personnel become thoroughly familiar with the signs, symptoms, and treatment of neurocirculatory collapse to assure early recognition and treatment. Cases occurring in actual flight can be aided by crew members until a physician's services are obtained.

Currently, there is much to be learned about the etiology, physiology, clinical picture, and treatment of this condition. The School of Aviation Medicine has issued an excellent practical guide[1] for treating these patients. To generalize about the management of these cases is not without danger. Here as in the practice of medicine generally, a physician must individualize.

To our knowledge, the true cause of neurocirculatory collapse at high altitudes has not as yet been pinpointed. The consensus of medical opinion seems to be that the causative factor is usually an ischemic hypoxia from gaseous emboli and/or vasospasm which may be localized or generalized and which may affect any organ or parts of any organ.

From U. S. Air Force Hospital, Ellington Air Force Base, Tex.

Many factors predispose to or protect against the development of neurocirculatory collapse. Among these are age, weight, altitudes attained, duration of exposure to high altitudes, individual fatigue, emotional factors, physical condition, et cetera. The average person over 35 years of age seems more prone than a younger man to develop this syndrome. The same is true of one who is obese or fatigued. Of course, the greater the altitude attained and the longer the time spent at high altitudes, the more apt is the person to succumb. It is very seldom that neurocirculatory collapse is seen at true cabin altitudes of less than 30,000 feet; however, it is possible to develop neurocirculatory collapse at cabin pressures found at 20,000 to 25,000 feet.

In this article the term neurocirculatory collapse refers to the mixed type of collapse rather than one in which either neurologic or circulatory symptoms predominate. The mixed cases are the most common after exposure to reduced pressure. Manifestations may consist of motor and/or sensory disturbances, visual abnormalities, restlessness, paralysis, pallor or cyanosis, hypotension or hypertension, retinal vasospasm, cardiac abnormalities, nausea, vomiting, hypothermia or hyperthermia, faintness, skin mottling, pruritus, sweating, et cetera. The picture may be quite bizarre.

It is essential to note that symptoms may be delayed for 12 hours or more after either actual or simulated flights. The history is extremely important.

The key to prevention of serious collapse is not to dismiss any unusual symptom as being unimportant. Even with early treatment the patient may go downhill rapidly, as was true in the case herein reported. It is customary at this hospital to hospitalize and closely observe for at least 24 hours any person exhibiting any signs or symptoms of serious or questionable import during or after actual or simulated flights. The extra ounces of prevention and conservatism have borne fruit. We have a very deep respect for the insidiousness and potential dangers of signs or symptoms which may initially seem to be innocuous.

The most frequent manifestations of decompression sickness are known as "bends"; this clinical group is 8 to 10 times as common as the more serious group referred to as "chokes."

The following report concerns a patient treated at this hospital following a simulated flight.

## CASE REPORT

On 19 March 1954, at 1330 hours, a 33-year-old Air Force major underwent a chamber flight. He was 72 inches tall, weighed 195 pounds, and was moderately obese and well nourished. Prior to the chamber

flight he felt a little fatigued and "just didn't feel well" but did not report this. The chamber ascent was made at a rate which gradually increased from 1,000 feet per minute to 3,000 feet per minute; the peak altitude of 43,000 feet was reached at 1402 hours. Thirty seconds later the officer placed his hand to his forehead as if to indicate dizziness or discomfort, then rubbed his shoulders to indicate pain. The chamber was immediately dropped and at 30,000 feet he lost consciousness and urinated involuntarily. Inside the chamber the observer requested immediate descent, used the emergency setting of the oxygen regulator on the patient, and requested the immediate services of a flight surgeon. At 1407 hours the patient was at ground level and semicomatose; the flight surgeon put him to bed in the physiological training unit's recovery room, and continued the administration of 100-percent oxygen by mask. The patient complained of dizziness, twitching eyelids, numbness of both arms (particularly the elbows), mild generalized cephalalgia, and blurring of vision.

At 1410 hours the blood pressure was 150/80 mm. Hg; pulse, 96; and respirations, 18. Response to questioning was slow and the sensorium was clouded, but the patient was oriented as to time and place. Nystagmoid eye movements, cool and moist skin, and hyperesthesia of the forearms were present. Dextran was started, 28 to 30 drops per minute being given intravenously. The blood pressure fell to 110/80 mm. Hg and the pulse increased to 108. Other objective and subjective signs and symptoms remained relatively unchanged. The patient was moved by litter to a hospital ward at 1500 hours where better care could be given. Oxygen and dextran were given continuously during the movement, but he became very pale, began to sweat profusely, and vomited clear material. The pulse became more rapid and weak.

On admission to the hospital the blood pressure was unobtainable, the pulse was weak and thready with a rate of 150, respirations were 40 and shallow, skin was cool and moist, and marked pallor was evident. The lungs were clear and there was no paralysis. Surprisingly, the sensorium had improved slightly. Conventional shock therapy was instituted and the response was rapid; in about 5 minutes the blood pressure was 90/50 mm. Hg; the pulse, 140; the respiration, 30; and the skin regained normal color and temperature. Shock blocks were removed.

At 1730 hours the blood pressure was stabilized at 120/70 mm. Hg, the pulse at 96, and the respiration at 16. Temperature was 98.6° F. Examination and questioning of the patient at this time revealed dizziness, frontal headache, blurring of vision, paresthesia of both forearms, inability to maintain visual fixation, bilateral nystagmus, diminished corneal reflexes, and sluggish pupillary reactions to light. The abdomen was moderately distended generally; gastrointestinal gas was increased and peristalsis was normal to slightly increased. At 1840 hours the patient became very restless and vomited a clear liquid material. Vomiting occurred again at 1930 hours; however, on this occasion the vomitus was noted to be a brown liquid.

At 2130 hours the patient became very restless and quite confused mentally. The skin of his face and neck was mottled, and funduscopic examination revealed spasm of retinal arterioles and blurred disk margins. Administration of oxygen by mask was continued until 2150 hours when a tent was used. Special nurses were assigned and the patient closely observed from the time of initial hospital admission, with recordings every 15 minutes of blood pressure, pulse, temperature, condition, et cetera. After the 2130-hour examination a spinal tap was performed and 12 ml. of spinal fluid was *slowly* removed. Spinal fluid pressure was reduced from 260 mm. of water to 140 mm. of water. During the following 1½ hours the patient seemed much less confused mentally and less restless. However, at 2310 hours he became semicomatose, and hyperventilation began with carpopedal spasms. The spasms were controlled by use of a paper sack over the nose and mouth for rebreathing.

Laboratory findings were as follows: The urine was cloudy and acid, with a specific gravity too high to read; it was negative for albumin; there was a trace of sugar and of acetone. The hemoglobin was 15.6 grams per 100 ml.; the hematocrit, 54. Spinal fluid was clear, with 17 cells (7 polymorphonucleocytes and 10 lymphocytes); sugar was 36 mg.; chlorides, 715 mg.; and total protein, 98.7 mg., all per 100 ml. An electrocardiogram showed inverted T waves in leads $V_1$ and $V_2$, diphasic T waves in $V_3$ and $V_4$.

Treatment consisted, during appropriate periods, of 1,000 ml. of dextran, 500 ml. of whole blood, and 30 ml. of 50 percent dextrose intravenously; and vasoxyl (brand of methoxamine hydrochloride), paraldehyde, chloral hydrate, penicillin, and oxygen.

On 20 March carpopedal spasm continued intermittently for about 2 hours. The patient became more deeply comatose, and was restless and incontinent of urine. At 0830 hours his temperature was 102.2° F. by rectum; blood pressure was 132/84 mm. Hg; pulse, 134; and respirations, 24. At 1030 hours he had an emesis containing old blood. The abdomen was generally distended. After vomiting ceased, 10 ml. of spinal fluid were allowed to drain off slowly. This reduced the spinal fluid pressure from 160 mm. of water to 110 mm. of water. A Levin tube was inserted and Wangensteen drainage started.

At 1400 hours the coma became very deep; the patient's pupils became fixed and corneal reflexes were absent. Cheyne-Stokes respirations began and continued intermittently for about 2 hours. The temperature increased to 104.6° F. by rectum. At 1900 hours, coma remained deep and response was possible only to supraorbital pressure. This response mainly consisted of movement of his left lower extremity and slight movement of his right lower extremity. The pupils were small, fixed, and did not react to light. Corneal reflexes were absent bilaterally. A gag reflex was present and deep tendon reflexes were minimal except for a hyperactive right biceps jerk. Abdominal and

cremasteric reflexes were absent. Strong Babinski, Chaddock, and Oppenheim signs were present on the right; the Babinski sign was weakly present on the left. A right spastic hemiparesis was noted, particularly in the lower extremity.

Respiratory excursions were shallow and erratic. Four physicians examined the lungs by percussion, auscultation, and palpation; no noteworthy findings were discovered except for a deepening of the tissues over the suprasternal notch with each inspiratory effort, and a suggestion of a possible tracheal obstruction with tenacious secretions. Some laryngeal stridor was present. Because of the respiratory difficulty and the critical condition of the patient, and with a view to aiding nursing care, it was decided to perform a tracheotomy under local anesthesia. This was accomplished at 2200 hours. Much thick tenacious and clear mucoid material was removed by suction from the trachea and upper bronchial tree. This material was undoubtedly the main cause of the patient's respiratory difficulty because he immediately began to breathe more easily and rested much more quietly the rest of the night.

Laboratory findings were as follows: The urine was yellow, hazy, and acid, with a specific gravity of 1.040; it was negative for albumin, acetone, and bile; sugar was 2 plus; there were 8 to 10 white blood cells and 4 to 5 epithelial cells per high power field. The red blood cell count was 5,600,000 per cu. mm. (at 0200 hours) and 4,900,000 (at 1000 hours). Hemoglobin was 16.3 grams per 100 ml. (at 0200 hours), and 14.8 (at 1000 and 1500 hours). Hematocrit was 49 percent (at 1000 hours) and 46 (at 1500 hours). The white blood cell count was 20,000 per cu. mm., with 85 percent polymorphonucleocytes, 12 percent lymphocytes, and 3 percent monocytes (at 1000 hours); and 16,700, with 87 percent polymorphonucleocytes, 10 percent lymphocytes, and 1 percent monocytes (at 1500 hours). The $CO_2$ combining power was 23 volumes percent. The spinal fluid was slightly cloudy, with 21 cells (6 polymorphonucleocytes, 15 lymphocytes); sugar was 26 mg.; chlorides, 743 mg.; and total protein, 183 mg.; all per 100 ml.

Treatment consisted of tent oxygen, 500 ml. of dextran, 2,000 ml. of 5 percent dextrose in distilled water, 100 ml. of human serum albumin, 500 ml. of plasma, streptomycin, penicillin, paraldehyde, and phenobarbital sodium.

On 21 March the patient's temperature remained fairly constant, in the vicinity of 102° F. (rectal) during the early morning hours and at about 101.4° F. throughout the remainder of the day. By 0800 hours his coma had definitely decreased, but it was not possible to arouse him completely. By 0900 hours he could be aroused, and answered simple questions with an affirmative nod or a negative shake of his head. At 1500 hours there were the following findings: slight restlessness with moderate movements; slight to moderate dehydration; small, equal pupils which reacted normally to light; diminished right corneal

reflex; absent left corneal reflex; a 1-plus spasm in several arteriolar segments on funduscopic examination; equal and active deep tendon reflexes; absent abdominal and cremasteric reflexes; bilaterally equal strength in legs, arms, and hands; Babinski reflex present on right and absent on left; and positive Chaddock and Oppenheim signs on right. The patient's general condition improved steadily throughout the day and by 2000 hours he was able to answer questions in a rational and coherent fashion. At this time, both pupillary and corneal reflexes were normal. The abdominal reflexes had returned, but the cremasteric reflexes remained absent. Blood pressure was 138/80 mm. Hg; pulse, 80; and temperature, 101° F. He rested well during the night.

Laboratory findings were as follows: Red blood cell count was 3,900,000; hemoglobin was 14.5 grams (at 0800 hours) and 12.7 grams (at 1600 hours), both per 100 ml. Hematocrit was 44 percent (at 0800 hours) and 40 percent (at 1600 hours). The white blood cell count was 12,400 per cu. mm., with 84 percent polymorphonucleocytes and 16 percent lymphocytes. The $CO_2$ combining power was 28 volumes percent.

Treatment consisted of 1,000 ml. of plasma, 3,000 ml. of 5 percent dextrose in distilled water, streptomycin, penicillin, and multivitamins.

On 22 March the patient's condition was much improved; he was able to take liquids and a soft diet. The only positive findings remaining were a slight mental dullness with some difficulty in memory for recent events, slightly diminished visual acuity bilaterally, and slightly less strength in the right lower extremity as compared to the left.

Improvement was rapid and all neurologic findings and vision were normal by 25 March. Convalescence was uneventful and the patient was discharged to duty (not involving flying) on 12 April. On 16 April he was returned to flying with instructions to remain at altitudes of 20,000 feet or less.

## DISCUSSION

The advisability of spinal punctures in cases of neurocirculatory collapse is debatable. Some neurosurgeons are convinced that spinal punctures should never be performed in this condition, whereas others are just as strongly convinced that the procedure should be done. In a case previously reported,[2] performance of a spinal puncture with slow release of spinal fluid markedly improved the patient and seemed to be the lifesaving therapeutic procedure. In the case reported above, improvement was only temporary, but definite for short periods; however, spinal puncture may have contributed to the later regression of the patient. Spinal puncture was not performed in any of the seven fatal cases described by Adler.[3] He emphasized that, although it may have been coincidental, several patients in his report improved clini-

cally soon after spinal tap. Decision as to whether or not to perform spinal puncture must rest with the individual physician. Until more positive proof is obtained indicating that such procedures are precluded, we will continue to lean toward using careful spinal punctures.

In retrospect, it may have been better in this instance not to have moved the patient from the emergency room of the physiological training unit so soon. However, it was decided to move the patient to the hospital because better care could be afforded him there than was possible in a small, crowded emergency room.

It is extremely important that fluids given intravenously be administered at a very *slow* rate to prevent sudden pulmonary edema, cerebral edema, or overtaxing of an already overloaded cardiovascular system.

This case well demonstrates the rapidity with which changes in the patient's condition can occur, and stresses the need for constant close medical observation. The initially increased total white blood cell count with increased polymorphonucleocytes and the initially increased spinal fluid pressure, the persistence of spinal fluid cells, the persistently elevated spinal proteins, and the decreased spinal fluid sugar can easily confuse the diagnosis and suggest one of the meningitides or other central nervous system infections unless the physician obtains a good history and is familiar with the neurocirculatory collapse syndrome. It is stressed that some patients may exhibit no symptoms or only slight symptoms until several hours after a flight is completed. The initial hemoconcentration in this case may be related to the "blood sludging" described by Knisely and Bloch.[4]

The decreased $CO_2$ combining power probably reflects the severity of the patient's shock, although in this case one might have expected an increase in the $CO_2$ combining power in view of the marked hyperventilation that was noted even while the patient was comatose or semicomatose. The exact reason for the patient's hematemesis was unknown. There are many possible causative factors which will not be discussed here.

The turning point for improvement in this patient apparently was the tracheotomy.

Immediately after the above incident it was decided to obtain more information on all trainees prior to chamber ascents. As a result a combined physical examination-questionnaire form was prepared for recording the trainee's name, age, height, weight, pulse, temperature, blood pressure, et cetera. All personnel assigned to the physiological training unit were given special instructions in the methods of obtaining this information. It was

obligatory that the trainee himself complete the form with information concerning previously experienced symptoms during actual or simulated flights to high altitudes, past history of headaches or fainting or emotional disturbances, any feeling of present fatigue or illness (cold, sore throat, sinusitis, ear defects, fever, diarrhea, et cetera), history of recent immunizations, use of alcoholic beverages, physical defect waivers, et cetera. Any trainees 35 years of age or over, those overweight, and those indicating by our physical findings or by their answers that their case should be further investigated are interviewed personally by the physiological training officer, who records appropriate comments on the form. The trainee is then interviewed by a flight surgeon who makes the final determination as to whether a flight should be undertaken. This procedure has considerably reduced the number of chamber reactions; in the 14 months since use of the form was initiated, no serious reaction has occurred locally during simulated flights.

Further research, study, and reporting of neurocirculatory collapse cases by the medical profession is believed indicated to afford more information in regard to the causes, clinical picture, and therapy of this syndrome.

## SUMMARY

In a case of neurocirculatory collapse resulting from simulated altitude flight, many bizarre neurologic and circulatory signs and symptoms were noted. The patient also demonstrated the rapidity with which clinical improvement can change. Therapy consisted primarily of close observation and conservative medical care; however, two spinal punctures and a tracheotomy were also performed. The spinal punctures only temporarily aided the patient; however, the tracheotomy marked the turning point toward improvement and eventual recovery. Use of a locally prepared combined physical examination-questionnaire form has considerably reduced the number of chamber reactions, and no serious reactions during simulated flights have occurred in the 14 months since use of the form was initiated.

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# Primary Carcinoma of the Jejunum With Massive Gastrointestinal Hemorrhage

TIMOTHY N. CARIS, *Captain, USAF (MC)*
BRUNO EISEN, *Captain, MC, USA*
CLESTON W. GILPATRICK, *Major, MC, USA*

PRIMARY carcinoma of the jejunum is uncommon, but this site is the most frequent one for carcinoma of the small intestine. In 1940, after a survey of cases for 32 years, 108 malignant tumors of the small intestine were reported by the Mayo Clinic.[1]

Massive gastrointestinal hemorrhage as the presenting symptom of carcinoma of the jejunum is sufficiently rare to justify the report of a single case.

## CASE REPORT

The patient, a 21-year-old man, sought medical attention because of progressive and easy fatigability and marked weakness for the preceding 12 hours. The patient had not felt well for the previous 4 months because of nervousness and easy fatigability.

The history by systems was noncontributory except for occasional burning in the epigastrium. These episodes were infrequent, not related to nor modified by the ingestion of food. There was no history of nausea, vomiting, hematemesis, and tarry or bloody stools. Physical examination revealed an apprehensive, pale, afebrile white man with a pulse rate of 110 per minute and a blood pressure of 110/70 mm. Hg. The remainder of the examination revealed no significant abnormality except for blood on the examining finger following rectal examination.

Within 1 hour after admission to the hospital the patient had a large bloody bowel movement. Sigmoidoscopic examination revealed no bleeding sites, but blood could be seen coming from above the end of the sigmoidoscope. A gastrointestinal series performed 12 hours after admission revealed considerable spasm of the pylorus. The duodenal bulb did not fill until 15 to 20 minutes after the ingestion of the barium; then it was irritable and emptied frequently except for a speck of barium on the midportion of the posterior wall. On all spot films a persistent rounded patch of barium with a radiolucent ring (thought to be due to edema) was seen (figs. 1 and 2). The remainder of the upper gastrointestinal tract was thought to be normal.

From Brooke Army Hospital, Brooke Army Medical Center, Fort Sam Houston, Tex.

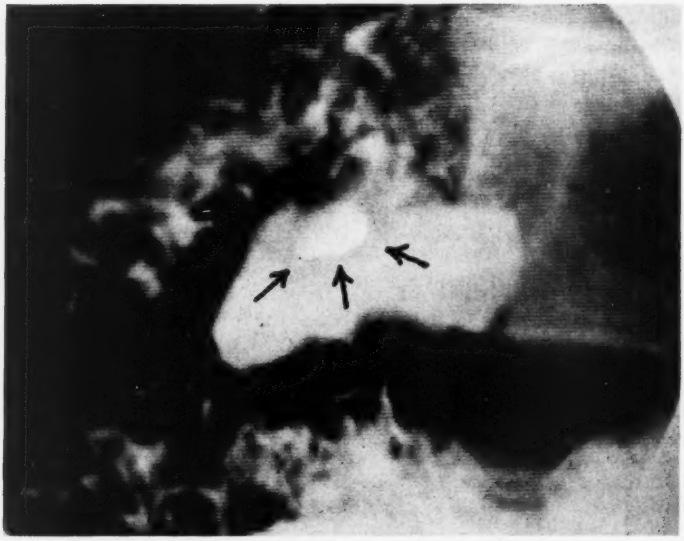

*Figure 1. Anteroposterior view of the duodenal bulb, demonstrating the simulated ulcer "crater" filled with barium and the surrounding radiolucent zone thought to be edematous marginal tumor.*

*Figure 2. Right anterior oblique view of the duodenal bulb, demonstrating the barium-filled "crater" and surrounding zone of radiolucency.*

On admission the patient's hemoglobin was 10.7 grams per 100 ml. with a hematocrit of 32 percent. He received 1,500 ml. of whole blood in the next 36 hours, and during this time he had three additional bloody bowel movements. The patient's pulse rate remained persistently over 110 with a blood pressure of 100 mm. Hg systolic. Even after receiving the blood, the patient's hemoglobin was found to be 10.7 grams per 100 ml. with a hematocrit of 33 percent. It was believed at this time that the patient had a persistently bleeding duodenal ulcer and that surgical intervention was indicated.

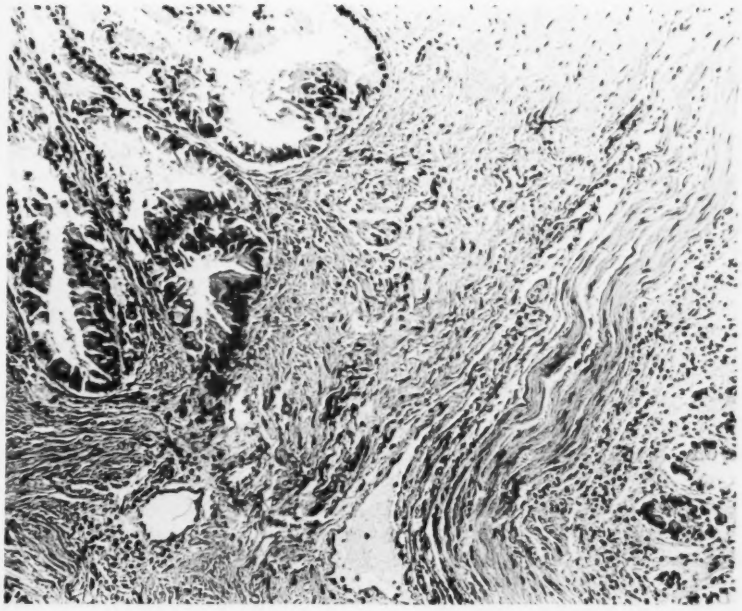

*Figure 3. Photomicrograph of jejunal mucosa adjacent to the polypoid tumor base. The base of the jejunal mucosa can be seen with the underlying muscularis mucosa. In the submucosa there are glands of tumor cells invading laterally from the base of the polypoid tumor. (× 105)*

A bilateral subcostal incision was used for exploration. On entering the peritoneal cavity, blood was seen within the small and large bowel. Examination of the small bowel at the ligament of Treitz, however, failed to show blood in this area. An intraluminal tumor was encountered about 18 inches distal to the ligament. The small bowel was opened away from the tumor and examination revealed an adenomatous polyp measuring 5 cm. in diameter. Two areas of ulceration measuring 4 to 5 mm. in diameter were adjacent to the mass. These were definitely identified as the site of bleeding. The small bowel was resected, taking about 5 inches on both sides of the tumor, and an end-to-end anastomosis was performed.

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Because of the clinical and radiologic diagnosis of duodenal ulcer, a duodenotomy was performed. No abnormality could be detected visually or by palpation, and the duodenum was closed. The abdominal wall was closed in layers, and the patient made an uneventful postoperative recovery.

Pathologic studies showed the tumor to be adenocarcinoma of the jejunum without lymph node involvement (fig. 3).

A repeat upper gastrointestinal series 1 month postoperatively showed no abnormalities.

## SUMMARY

**Gastrointestinal bleeding in a young man was diagnosed clinically (and confirmed radiologically) as a bleeding duodenal ulcer. In spite of therapy, the patient continued to bleed and a laparotomy was performed. At the time of operation the duodenum was found to be normal, and a polypoid adenocarinoma encountered in the jejunum about 18 inches from the ligament of Treitz was resected.**

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## THE AIR WAY IN ACUTE HEAD INJURY

The occurrence of concomitant chest injuries among patients suffering from head trauma further increases the mortality rate. Tracheostomy has been shown to have definite therapeutic effects in this group: a mechanical cleansing of the airway by easy removal of excessive fluids or blood from the tracheobronchial tree, as well as relief of laryngeal obstruction from edema, bleeding, or faulty function of the vocal cords; and a physiological decrease in the amount of dead space in the respiratory tract, and a diminished resistance to breathing. Furthermore, tracheostomy has the advantages of being a well-tolerated, simple, and single procedure. It is direct and definitive. Less experienced ward help can take over aspiration and management of the oxygen catheter; and alcoholic, intractable, and severely injured patients are most easily managed in this manner.

—ALEX W. ULIN, M. D.,
and HUBERT L. ROSOMOFF, M. D.
in *A. M. A. Archives of Surgery*,
p. 760, Nov. 1953

## A MESSAGE FROM THE A. M. A.

Less than 60 hours before the Doctor Draft Law would expire, Congress sent the bill to extend this law for 2 more years to the White House for signature. On 30 June at 7:10 p. m., the President signed the bill which became Public Law 118, 84th Congress.

The continuation of this special draft law, as amended and extended, retains the same four priorities for the call-up of physicians to active duty as was contained in the old law. The Doctor Draft remains in effect for 2 more years or until 1 July 1957. In addition, the $100 per month equalization pay for physicians, dentists, and others on active military duty was continued for 4 more years or until 1 July 1959. The new law provides only two major changes from the old act. First, it exempts from military service any physician or dentist, 35 years of age or older, whose application for a commission in one of the armed services as a physician or dentist is or has been rejected on the sole ground of a physical disqualification. Secondly, the age limit for call-up of special registrants was lowered from 51 to 46. After 1 July, all physicians who have reached their forty-sixth birthday are exempt from involuntary induction into the Armed Forces.

It should be noted that these two changes are not retroactive. Physicians already on active duty prior to 1 July are not eligible for discharge even though they would be exempt from induction under the recently enacted changes. Such individuals must serve their obligated tours of duty as provided for in the provisions of the old law. The Department of Defense also emphasized that those persons who were merely classified 4-F by their draft boards likewise would not be affected by the new amendment. Only those persons who applied for a commission as a medical or dental officer in one of the armed services and were rejected on physical grounds would be exempt.

The American Medical Association actively opposed the continuation of this highly discriminatory law. The Doctor Draft Act extension originally introduced as H. R. 6057, 84th Congress, was favorably reported by the House Armed Services Committee after hearings had been conducted. Approval was withheld by the House Rules Committee until further justification for the extension was presented by the Armed Services Committee.

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From the Council on National Defense of the American Medical Association. The views and opinions expressed are not necessarily those of the Department of Defense. —*Editor.*

The Senate then added the Doctor Draft as a separate title to the regular draft bill for a 4-year extension of the Universal Military Training and Service Act, which was passed by the House in February. This combined bill (H. R. 3005) was passed by the Senate on 16 June.

However, there were several major and some minor differences between the House version of the bill, which dealt solely with the regular draft, and the Senate bill, which included the Doctor Draft extension with the regular draft provisions.

A Conference Committee of House and Senate members was appointed to resolve these differences. The Conference report was called up for House action on 28 June.

It is significant to realize that the procedure up to this point was to tie in the Doctor Draft extension with the vital extension of the regular draft, and on the basis of a Conference report to force a vote on the bill without consideration, debate, and amendments under the usual rules and practices of the House of Representatives.

To prevent this action, after the Conference report was called up for House consideration, a motion was introduced to recommit the bill to the Conference Committee. This motion was defeated by a vote of 221 to 171.

Following this the House then voted 388 to 5 to accept the Conference report which in effect passed the act. Shortly thereafter the Senate passed, without opposition, the compromise measure as agreed upon by House and Senate conferees.

In its testimony before the Senate Armed Services Committee, the American Medical Association pointed out that "The provision of an adequate career medical officer procurement program for the Armed Forces is the problem that must be solved today. Continuation of the Doctor Draft will not solve this problem, but it has apparently become easier to postpone a solution by convincing Congress every two years that the law should be extended than to solve the basic problem involved."

It is gratifying to report that during the latter part of July, the Department of Defense called a conference between representatives of the Military, the medical profession, and the dental profession for the purpose of outlining an attractive career program to resolve this vital and acute problem. The American Medical Association has long been on record as endorsing the principles of such a program and sincerely hopes that implementing legislation can be passed without delay.

# PROMOTIONS OF OFFICERS

The following officers of the military medical services on active duty in the Army, Navy, and Air Force have recently received *temporary* promotions to the rank indicated:

## Medical Corps

George C. Alderman, Lt., USN
Kenneth Z. Altshuler, Lt., USN
Richard R. Anderson, Lt., USN
William H. Baird, Lt., USN
Ortha J. Barnette, Lt., USN
Jack Behrman, Lt., USN
Arthur Brody, Lt., USN
Otto C. Brosius, Maj., USA
Don M. Burman, Lt., USN
Carl H. Cather, Jr., Lt., USN
Henry S. Carter, Lt., USN
Samuel P. Copeland, Jr., Lt., USN
Leonard J. Corwin, Lt., USN
John W. Cox, Lt., USN
Frank R. Dexheimer, Lt., USN
Philip R. Dodge, Maj., USA
Kenneth V. Dole, Lt., USN
Leonard Doloff, Lt., USN
Robert A. Eastwood, Lt., USN
Meade C. Edmuids, Jr., Lt., USN
Charles W. Ehlers, III, Lt., USN
Edward N. Ehrlich, Lt., USN
Lee W. Elgin, Jr., Lt., USN
Ira I. Eliasoph, Lt., USN
Irving P. Eney, Lt., USN
Armand Fadul, Lt., USN
Laurence H. Feenstra, Lt., USN
Lester M. Felton, Jr., Lt., USN
Eugene M. Fierer, Lt., USN
Glenn A. Folmsbee, Lt., USN
Milton L. Godley, Lt., USN
Henry E. Goetz, Lt., USN
Frank A. Hamilton, Jr., Lt., USN
George R. Hart, Lt., USN
Gene R. Hay, Lt., USN
Donald G. Helgren, Lt., USN
William N. Hill, Jr., Lt., USN
William K. Howard, Maj., USA
John C. Huffer, Lt., USN
William A. Jamison, Lt., USN
Arthur J. Johnson, Lt., USN
Reinold J. Jones, Lt., USN
Alcee J. Jumonville, Lt., USN
Meyer Kaplan, Lt., USN
Martin G. Koloski, Lt., USN
Bernard Krasner, Lt., USN
John M. Kroyer, Maj., USA
Kendrick P. Lance, Lt., USN
Robert R. Leonard, Maj., USA
Peter B. Lesslie, Lt., USN
Harvey R. Leventhal, Lt., USN
John H. Lohnes, Lt., USN
Eugene W. Mauch, Lt., USN
Donald J. Mehan, Lt., USN
Allan T. Moss, Lt., USN
Paul F. Nora, Lt., USN
Edward M. Ornitz, Lt., USN
Lee C. Park, Lt., USN
Phanor L. Perot, Jr., Lt., USN
Peter S. Pinto, Lt., USN
Rawdon E. Rambo, Lt., USN
John M. Reisser, Jr., Lt., USN
Richard J. Schilling, Lt., USN
Thomas F. Silva, Jr., Lt., USN
Edward C. Sinnott, Lt., USN
Robert A. Smith, Lt., USN
John F. Soderstrom, Lt., USN
Joseph H. Stephens, Lt., USN
Benjamin C. Stevens, Jr., Lt., USN
Wendell A. Stimets, Lt., USN
Richard H. Tabor, Lt., USN
Joseph J. Territo, Lt., USN
Gordon L. Tobias, Lt., USN
Lawrence E. Trabaudo, Lt., USN
Richard H. Trapnell, Lt., USN
Thomas W. Turner, Lt., USN
Lawrence L. Washburn, Maj., USA
John B. Weeth, Lt., USN
Jack C. Westman, Lt., USN
John G. Wilson, Lt., USN
Richard W. Wingfield, Lt., USN
Robert L. Wolf, Lt., USN
Mast Wolfson, II, Lt., USN

## Dental Corps

John H. Abercrombie, Capt., USAF
John A. Babett, Capt., USAF
Jack Badner, Lt., USN
Raymond C. Baron, Capt., USAF

## Dental Corps—Continued

John H. Belser, Maj., USA
Gordon H. Bicknell, Lt., USN
James J. Bouressa, Capt., USAF
Seymour L. Brown, Lt., USN
Martin M. Brownstein, Lt., USN
Howard Bruggers, Capt., USAF
Fred W. Bruner, Capt., USAF
Donald J. Burns, Capt., USAF
Thomas C. Chianese, Lt., USN
Everett J. Collings, Capt., USAF
Van E. Collins, Maj., USA
William I. Conrad, Capt., USAF
Thieran A. Cromartie, Lt., USN
James A. Cross, Capt., USAF
Robert P. Dahman, Capt., USAF
Robert H. Evans, Jr., Capt., USAF
Raymond W. St. Eve, Capt., USAF
Edward L. Fassler, Capt., USAF
Thomas D. Flautt, Capt., USAF
Willard L. Flint, Capt., USAF
Carl H. Freeborn, Capt., USAF
Sidney A. Geise, Capt., USAF
Harold N. Glasser, Lt., USN
John D. Glesmann, Capt., USAF
Edwin C. Gordon, Capt., USAF
Edward Green, Capt., USAF
Andrew J. Haas, Capt., USAF
Robert M. Hall, Lt., USN
George A. Haltiwanger, Capt., USAF
Richard P. Hansen, Lt., USN
Byron D. Harrison, Lt., USN
Jonas W. Hockman, Jr., Capt., USAF
Charles G. Hodson, Lt., USN
Philip J. Holton, Lt., USN
Norbert L. Immel, Lt., USN
Bruce D. Jones, Lt., USN
Joel A. Kalafa, Capt., USAF
James Kelly, Capt., USAF
John G. Koehler, Capt., USAF
Eugene M. Koval, Capt., USAF
James M. Lansche, Capt., USAF
John J. Lavelle, Jr., Lt., USN
Robert K. Laws, Lt., USN
Edward M. Lawson, Lt., USN
Louis J. Lodico, Jr., Capt., USAF
Harold Loewenthal, Lt., USN
Ralph W. Lucia, Lt., USN
Irving R. Lunt, Jr., Capt., USAF
James J. Lyons, Lt.. USN
Rodney W. Maasch, Capt., USAF
Gordon K. Magnusson, Lt., USN
Arthur F. Mahler, Capt., USAF
Kenneth Marshall, Capt., USAF
Earl L. Masters, Jr., Capt., USAF
Richard A. McIntosh, Lt., USN
Robert W. Mendel, Lt., USN
Donald C. Meyer, Capt., USAF
Thomas O. Miller, Capt., USAF
Wendel E. Montgomery, Lt., USN
Ira M. Niederman, Capt., USAF
Donald W. Ourada, Capt., USAF
Milton Palat, Capt., USAF
Joseph Pavalko, Capt., USAF
Frank J. Pellizzari, Lt., USN
John W. Phillippi, Lt., USN
Thomas R. Pirsch, Capt., USAF
Richard L. Pourciau, Capt., USAF
Glenn J. Pratt, Capt., USAF
John F. Principe, Capt., USAF
Albert Rappaport, Lt., USN
Donald K. Rice, Lt., USN
Morton W. Rose, Capt., USAF
Bruno E. Schiffleger, Capt., USAF
Charles R. Schroldes, Maj., USA
Murray Schwartz, Capt., USAF
Edmond L. Senty, Capt., USAF
Edward J. Setlik, Capt., USAF
George B. Sidford, Capt., USAF
Robert W. Slater, Lt., USN
Edwin D. Snyder, Capt., USAF
John B. Sowter, Lt., USN
David Steckel, Capt., USAF
Donald C. Steele, Capt., USAF
Alvin L. Steinberg, Jr., Lt., USN
John A. Striebel, Capt., USAF
Charles R. Sullivan, Lt., USN
Daniel M. Telsey, Capt., USAF
Earl T. Terp, Capt., USAF
Herman B. Teter, Capt., USAF
Edgar G. Timm, Capt., USAF
Forrest L. Turner, Capt., USAF
John F. Tylicki, Lt., USN
Rodney F. Valentine, Lt., USN
Joseph R. P. Wall, Jr., Lt., USN
Henry S. Watson, Lt., USN
Lawrence A. Weinberg, Lt., USN
Myron S. Winer, Capt., USAF

## Medical Service Corps

Harold R. Bower, Lt., USN
Lenvol G. Bowers, 1st Lt., USAF
Clarke M. Brandt, 1st Lt., USA
Dennie L. Briggs, Lt., USN
John P. Charles, Lt., USN
Amerigo J. Cherubini, Maj., USA
Ned B. Curtis, Lt., USN
Gene M. Davis, 1st Lt., USAF
Robert M. Edwards, 1st Lt., USAF
Willard B. Fisher, Capt., USAF

## Medical Service Corps—Continued

Marvin B. Fleisher, 1st Lt., USAF
William C. Ford, Maj., USAF
Jacob R. Freeman, Maj., USA
Edward Ha, Jr., 1st Lt., USAF
Philip E. Hixon, 1st Lt., USAF
Halbert J. Hopper, 1st Lt., USAF
Louis R. Kaufman, Lt., USN
William R. Knowles, Capt., USA
Keith C. Kruger, 1st Lt., USAF
Donald V. McEvoy, 1st Lt., USA
Daniel J. Moncol, 1st Lt., USAF
Charles G. Myers, 1st Lt., USAF
Maurice W. Nichols, Maj., USA
Raymond J. O'Brien, Maj., USA
Schuyler C. Patrick, 1st Lt., USAF
Solomon C. Pflagg, Lt., USN
James J. Riccardo, Maj., USA
James T. Richards, Col., USA
William S. Rooney, Maj., USA
John P. Samuels, Maj., USA
Robert W. Schneider, 1st Lt., USAF
Edward R. Seefelt, 1st Lt., USAF
Edward M. Seright, 1st Lt., USAF
Franklin H. Snapp, 1st Lt., USAF
Frank Spasaro, Maj., USA
Theodore Stergiades, Maj., USA
Donald E. Still, Lt., USN
Jesse C. Strickland, Maj., USA
Ralph A. Trimble, 1st Lt., USAF
Robert E. Tuttle, 1st Lt., USAF
Howard Wills, Maj., USA
Richard H. Zyzak, 1st Lt., USAF

## Nurse Corps

Twila R. Adams, 1st Lt., USAF
Carolyn T. Andre, 1st Lt., USAF
Viola L. Andrus, Lt., USN
Elsie M. Armstrong, Capt., USAF
Geneva Ascott, 1st Lt., USAF
Helen C. Bailey, Capt., USAF
Marilyn J. Beam, 1st Lt., USAF
Caliope M. Belezos, Lt., USN
Margery E. Betzold, Capt., USAF
Joan M. Bevans, 1st Lt., USAF
Elizabeth A. Bires, 1st Lt., USAF
Janet L. Bivens, 1st Lt., USAF
Delores L. Brown, 1st Lt., USAF
Celia S. Byers, Lt., USN
Barbara J. Carpenter, Lt., USN
Marian F. Chittick, Lt., USN
Katherine P. Coleman, 1st Lt., USAF
Ann B. Cox, Lt., USN
Amelia M. Dalmaso, Lt., USN
Martha A. Dickson, Capt., USAF
Alice L. Dowling, 1st Lt., USAF
Ellen E. Drakes, Lt., USN
Annabelle W. Evans, Capt., USAF
Elizabeth L. Evans, Lt., USN
Florence F. Fintak, Maj., USAF
Mildred A. Frosch, Capt., USAF
Helene M. Girodon, Maj., USAF
Catherine M. Glynn, Lt., USN
Eleanor F. Gravell, Capt., USAF
Albena I. Griz, Lt., USN
Aldona M. Griz, Lt., USN
Eleanor T. Hanley, Lt., USN
Dorothy J. Hanson, Lt., USN
Margaret C. Hoffman, Capt., USAF
Hazel L. Hogan, Lt., USN
Arlene R. Hottinger, 1st Lt., USAF
Harriett E. Hummel, 1st Lt., USAF
Elizabeth A. Jablunovsky, Capt.. USAF
Kathleen V. Kennedy, Capt., USAF
Rose A. Kirsch, Lt., USN
Barbara E. Knox, 1st Lt., USAF
Pauline J. Kuenzi, Lt., USN
Kathleen M. Laughlin, Lt., USN
Geraldine M. Lenehan, 1st Lt., USAF
Barbara J. Longwell, 1st Lt., USAF
Gladys Madsen, Lt., USN
Dolores M. McAvoy, 1st Lt., USAF
Mayde M. McOnkey, Capt., USAF
Ida J. Noreen, 1st Lt., USAF
Mary G. O'Donnell, 1st Lt., USAF
Norma E. Parnis, 1st Lt., USAF
Irene A. Pennell, 1st Lt., USAF
Loretta V. Peterson, 1st Lt., USAF
Nora J. Petruzzi, 1st Lt., USAF
Mary R. Phillips, 1st Lt., USAF
Ruth M. Pojeky, Lt., USN
Constance A. Quinn, 1st Lt., USAF
Johnanna Reid, Lt., USN
Elizabeth A. Richardson, Lt., USN
Dorothy A. Ristoff, Lt., USN
Martha C. Ross, Capt., USAF
Constance H. Rowe, Lt., USN
Dorothy L. Schweiger, Lt., USN
June T. Seals, 1st Lt., USAF
Mary S. Stahlman, Lt., USN
Mary G. Stewart, Lt., USN
Ann B. Strank, Lt., USN
Julia P. Tarver, 1st Lt., USAF
Ursula E. F. Trappe, Lt., USN
Marion E. Warren, Lt., USN
Dorothy V. Wetzel, Capt., USAF
Laura C. Wheeler, Lt., USN
Judith E. Williamson, Capt., USAF
Blanche E. Wodka, 1st Lt., USAF
Rita G. Wosburgh, 1st Lt., USAF

# THE MEDICAL OFFICER WRITES

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Treanor, W. J., Capt., MC, USA; Cole, O. M., Maj., WMSC, USA; and Dabato, R., First Lt., WMSC, USA: Selective re-education and use of assistive devices. *Physical Therapy Rev.* 34: 618-625, Dec. 1954.

## DEATHS

COLEMAN, John Joseph, Major, MSC, USA, Providence, R. I.; 1262d Service Unit, U. S. Army Hospital, Fort Dix, N. J., attended Bryant Business College, Providence, R. I., in 1939; appointed a second lieutenant 31 March 1943; ordered to active duty 31 March 1943; died 3 July 1955, age 38, in Atlantic City, N. J., of injuries received in an automobile accident.

JIMISON, Robert Loomis, Lieutenant Colonel, VC, USA, Fort MacArthur, Calif.; 2002-07 Service Unit, Fort Meade, Md.; graduated in 1938 from the Ohio State University College of Veterinary Medicine; appointed a first lieutenant 7 June 1938; ordered to active duty 2 September 1941; died 16 July 1955, age 41, in Milford, Del., of injuries received in an automobile accident.

REESE, Thomas John, Major, USAFR (MSC) Carlisle, Pa.; 6208th U. S. Air Force Hospital, Clark Air Force Base, Philippine Islands; appointed a second lieutenant and ordered to active duty 23 January 1943; died 29 June 1955, age 37, of cardiac arrest.

SHIRLEY, Jack Morton, Lieutenant Commander (MSC) USN, McKinney, Tex.; U. S. Naval Air Station, San Diego, Calif.; entered the naval service in 1926; appointed a warrant pharmacist in 1942; died 6 July 1955, age 48, at the U. S. Naval Hospital, San Diego, Calif., of coronary thrombosis.

# NEW NAVAL HOSPITAL ON GUAM

On 2 November 1954 the new 14.5 million dollar U. S. Naval Hospital on Guam, Marianas Islands, was dedicated. Situated on a 137-acre plot on Agana Heights, this beautiful ultra modern hospital has facilities for 500 beds. The staff, consisting of 68 officers, 218 enlisted men, and 100 civilians, furnishes complete medical, surgical, and

dental care to military personnel, dependents, and fleet activities. Over 160 miles of wire and 38,000 tons of concrete were used in construction. This new medical facility is the second largest naval installation outside the Continental United States.

Quite as a sidelight to the construction of the Naval Hospital was the setting of a lock safe in concrete before it was found that no one had the combination. After all local experts failed in opening the safe, a Navy inspector sat down, turned his hearing aid to full volume, and dropped the tumblers by ear.

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People are different from one another, and when they are sick they are even different from themselves.

—JANET M. GEISTER, R. N.
in *R. N.*, p. 45, June 1955

# BOOKS

## Reviews of Recent Books

ANTISERA, TOXOIDS, VACCINES AND TUBERCULINS IN PROPHYLAXIS AND TREATMENT, by *H. J. Parish*, M. D. 3d edition. 227 pages; illustrated. The Williams and Wilkins Co., Baltimore, Md., 1954. Price $5.

The words "bacterial and virus diseases" which appeared in the title of the first two editions of this small book have been deleted from the present edition. The subject matter, however, continues to cover the basic principles of immunology and their practical application to the treatment and prevention of disease. Throughout the text, differences in practice between Great Britain and the United States are described, increasing the value of the book.

The volume is divided into three sections, the first of which is devoted to serology, immunity, and a review of basic immunology. Brief discussions of the various types of antisera comprise the second section. Methods of preparation of the items available and the use of each in prophylaxis and treatment is presented in clear outline form. The third section comprises more than one half of the book and is devoted to a description of products available for diagnosis, such as tuberculin and Schick test toxoid, and also those used for active immunization against disease. Controversial material is kept to a minimum and the author's emphasis is on a practical clinical approach. For example, he points out the need for using only certain syringes for each dilution of the Mantoux test because of the great difficulty in removing traces of tuberculin by usual sterilization procedures. A historical outline of dates important in serum therapy and immunizations concludes the book, which can be wholeheartedly recommended for physicians in general practice and preventive medicine.—*WARREN H. DIESSNER, Col., MC, USA*

DIAGNOSTIC ADVANCES IN GASTROINTESTINAL ROENTGENOLOGY, by *Arthur J. Bendick*, M. D. 144 pages; 75 illustrations. Grune & Stratton, Inc., New York, N. Y., 1954. Price $6.

This little book is intended for those radiologists and gastroenterologists who have been performing roentgenographic examinations for several years, yet are so situated that they cannot keep up with new technics and modern interpretations of roentgen findings. The author covers advances in roentgenologic equipment and preparation of contrast media. He gives considerable emphasis to detailed study of the mucosa, particularly the "club soda technic," which was developed by the author. This utilizes small amounts of iced carbonated water for hyperperistalsis and distention of the stomach.

The material is well organized, concise, and readable. Examination of the various portions of the gastrointestinal tract is covered in some

detail. Both sides of controversial points are not reviewed in detail, but rather the author gives his own opinions based on years of experience.

The book is well indexed and beautifully illustrated with 75 roentgenograms which bring out the points emphasized in the text. Bibliographic references have been generally omitted in order not to increase the size of the book.—*JOHN L. HATCH, Capt. (MC) USN*

A COMPREHENSIVE REVIEW OF DENTISTRY, For Use in Preparing for State Board Licensing Examinations, edited by *Vincent R. Trapozzano*, D. D. S., F. A. D. P., with the collaboration of 24 contributors. 2d edition. 665 pages. W. B. Saunders Co., Philadelphia, Pa., 1955.

This volume is presented with a twofold purpose; first, to serve as a guide for the Dental State Board examinee, and second, to aid in the review of dentistry by the general practitioner.

All of the basic sciences of the dental curriculum are covered, including operative dentistry, prosthodontics, oral surgery, orthodontics, roentgenology, and related topics. The material is arranged in a question and answer format, without detailed descriptions of technical procedures. Each chapter has been compiled by a recognized specialist in the field, and there is a short bibliography at the end of each chapter. The material is well indexed.

The author's twofold objectives are adequately accomplished, and within the limitations of these objectives this book can be recommended as an addition to the library of a prospective examinee or general practitioner.—*EDWIN H. SMITH, Jr., Lt. Col., DC, USA*

COLLECTED PAPERS OF THE MAYO CLINIC and The Mayo Foundation, edited by *Richard M. Hewitt*, M. A., M. D.; *A. B. Nevling*, M. D.; *John R. Miner*, Sc. D.; *James R. Eckman*, M. A., Ph. D.: *M. Katherine Smith*, B. A.; *Carl M. Gambill*, M. D., M. P. H.; *Florence Schmidt*, B. S. E.; and *George G. Stilwell*, M. D. Volume XLV 1953, published June 1954. 913 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1954.

Practical useful knowledge given in succinct, readily understandable prose describes the style in which this 913-page volume is written. This book reads like the best of clinical lectures. Statistics are held to a minimum and individual case records do not appear. Problems are posed on every textual page, their number making the book a small encyclopedia of up-to-date freshness. Problems even out of the average practitioner's field are presented without "going over his head."

This is a book the busy physician may read hurriedly between cases, or digest more thoroughly and with comfort at the day's end. The editors have quite uniformly captured in print a style of presentation of problems characteristic of the direct analytic approach of the best clinics. New, unusual, difficult, or even ordinary problems are so interestingly presented as to make their solution seem easier for having read this text.—*WILLIAM W. KIRK, Capt. (MC) USN*

ANGIOGRAPHIC LOCALIZATION OF INTRACRANIAL MASSES, by *Arthur Ecker*, M. D., Ph. D., and *Paul A. Riemenschneider*, M. D. 433 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $13.50.

This monograph is designed to serve as a much needed reference atlas for the localization of intracranial masses by the study of the displacement of the cerebral vessels as seen in the contrast angiogram.

It is divided into two parts, the first being composed of line drawings and general description of the material, orienting the reader to the position of vessels when displaced by masses in 27 specific regions of the brain. The second part consists of 27 chapters, each illustrating one of these regions by angiograms. Also presented are correlating clinical histories, additional illustrations, photographs of patients, plain films, pneumograms, and pictures of surgical exposures and of pathologic specimens.

The ability to localize intracranial masses can be greatly enhanced by the study of angiography. Its correlation with the clinical and pneumographic studies is especially important and is well illustrated in this book. By its use, certain herniations can be excluded and subsequent pneumography and lumbar puncture may be performed with greater safety. Information may also be gained preoperatively by the neurosurgeon, serving to localize the tumor more accurately. In addition, at times, a clearly inoperable tumor may be recognized.

This book is a valuable addition to our growing reference library in the highly specialized but important field of contrast radiography. It is recommended for all who would extend their knowledge in this direction.

—*S. F. WILLIAMS, Capt. (MC) USN*

REFLECTIONS ON RENAL FUNCTION, by *James R. Robinson*, M. D., Ph. D. 163 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1954. Price $3.50.

This small book emphasizes the normal physiology of the kidney and gives a summary of known physiologic, chemical, and endocrine principles involved in renal function. There is a splendid bibliography of 112 references.

A chapter is devoted to water and sodium excretion and an explanation of how the kidney elaborates hypertonic and hypotonic urine. The role of the kidney in acid-base balance is covered in detail, with discussion of how and when the urine is alkaline or acid. The role of the kidney as a regulator of the volume of the body fluids is carefully described. A great deal of information is centered on the kinetics and limitations of the kidney, but many secrets of its intimate mechanisms are yet to be revealed.

This book will be useful to physiologists, physicians interested in basic sciences, and residents in training in urology.

—*EARL C. LOWRY, Col., MC, USA*

LEGG-CALVÉ-PERTHES SYNDROME and Related Osteochondroses of Youth, by *Charles Weer Goff*, M. D. 332 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1954. Price $10.75.

The author has successfully written a monograph summarizing all present day knowledge of a clinical condition, challenging to the physician, and a rather common cause of residual disability in the adult. He also has faithfully and scientifically recorded his own experiences in the treatment of this condition and proposes a concrete plan for treating osteochondrosis with criteria of healing which will be helpful to other physicians.

The first portion of the book records the history of Legg-Calvé-Perthes syndrome with an account of the nature, possible causes, clinical manifestations, and treatment of this condition. In a section on the hip the normal and abnormal physiology of this joint and the pathology of this ill-defined disease is described. A portion of the book devoted to excellent reproductions of roentgenograms clearly illustrate typical cases. These are compared with roentgenograms of conditions which simulate Legg-Calvé-Perthes disease and will be of help in their differential diagnosis. Of interest is the tabulation of osteochondroses of various portions of the skeleton where confusion in diagnosis has existed.

Many references are listed which will assist those desiring to do further reading on the subject. All illustrations, graphs, and reproductions are excellent. The index is complete with bold print designating each letter of the alphabet.

This work, representing exhaustive research and scientific recording, will be an asset to the physician, especially the pediatrician and orthopedist, treating patients with these conditions. This effort should aid an earlier diagnosis and prevention of deformities; it will give physicians a clearer understanding of a plan for treatment which has heretofore been confusing and varied. —*ALFRED O. HELDOBLER, Maj., MC, USA*

INTELLIGENCE, by *L. J. Bischof*. 33 pages; illustrated. Doubleday and Co., Inc., Garden City, N. Y., June 1954. Price $0.85.

Since the first practical success by Alfred Binet in the measurement of intelligence, the notion of what is and what can be measured by tests has had considerable development and modification. This pamphlet reviews the theories associated with the names of Stern, Spearman, Thomson, Thorndike, and Thurstone. What is measured by tests of primary mental abilities is illustrated by copious examples of the sorts of tasks and problems included in the recent intelligence tests. The abilities assessed, such as word fluency, verbal meaning, perceptual speed, space, and memory, are defined with actual examples from tests. This work includes little for the psychologist that is new but is recommended reading for the medical or line officer who has interest in or responsibility for assessment programs.

—*WALTER L. WILKINS, Comdr. (MSC) USNR*

THE JOINTS OF THE EXTREMITIES, A Radiographic Study, Notes on Nonroutine Methods, Non-routine Ideas, and Less-common Pathology, by *Raymond W. Lewis*, M. D. 108 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $8.50.

This text was prepared especially for radiologists and orthopedic surgeons. No attempt was made to cover the fundamentals of x-ray diagnosis completely; instead, unusual ideas and less common disease state, are emphasized. Nonroutine positions are described and examples given to show their value.

The author believes that complete examination of the plain film using various projections will enable one to detect small deviations from the normal. Throughout the text he urges the detailed study of the soft tissues about the various joints. Routine films taken for bone detail are usually satisfactory for soft tissue study with use of a spotlight. The chapter on the knee is the most detailed one and well illustrates the importance of careful examination of the soft tissues on all films. Excellent examples of synovitis, cellulitis, pigmented villonodular synovitis, and synovioma are shown.

The book is well written and easy to read, with 102 illustrations of radiographs to illustrate the text. Most of these are accompanied by drawings or sketches to illustrate the anatomy and pathology. The index adequately covers the subject matter.

This "study" should prove valuable to all physicians concerned with interpretation of radiographs of the joints.

—*JOHN M. KOHL, Maj., USAF (MC)*

ANTIMICROBIAL THERAPY IN MEDICAL PRACTICE, by *Harrison F. Flippin*, M. D., F. A. C. P., and *George M. Eisenberg*, D. Sc. 304 pages; 11 tables and therapeutic index. F. A. Davis Co., Philadelphia, Pa., 1955. Price $5.

This volume contains a thorough and practical coverage of antimicrobial therapy. It is a timely book which is remarkably up-to-date in a field that is notable for rapid developments. The authors are eminently qualified by virtue of vast clinical experience to evaluate the numerous antimicrobial agents that have come into clinical use since the advent of this form of therapy.

The many antimicrobial drugs are individually discussed as to mode of action, pharmacology, dosage, toxicology, therapeutic indications, and contraindications. The laboratory aspects and complications of antimicrobial therapy are presented briefly but adequately.

The greater portion of the book is devoted to the treatment of specific infectious diseases. The various antimicrobic agents used in each of these conditions are discussed clearly and in detail. The authors have succeeded in crystallizing current thinking regarding the relative value of these agents in the various infectious diseases, and have produced a practical book that should be most useful in the everyday practice of medicine.—*GEORGE M. POWELL, Col., MC, USA*

METABOLIC INTERRELATIONS WITH SPECIAL REFERENCE TO CALCIUM, edited by *Edward C. Reifenstein, Jr.* 386 pages; illustrated. Sponsored by Josiah Macy, Jr. Foundation, New York, N. Y., 1954. Printed by Progress Associates, Inc., Caldwell, N. J. Price $5.

This book reports another Josiah Macy, Jr., Foundation Conference designed to assemble outstanding medical investigators for the purpose of informally integrating their personal ideas, experiences, data, and methods in the field of medicine. On this occasion the subject of calcium-phosphorus metabolism was chosen to further knowledge in metabolic interrelations.

Twenty-seven participants presented papers dealing with general aspects of internal transport of the mineral ions concerned with calcified tissues. Biochemical and physiologic aspects of calcium-phosphorus metabolism in research as well as in human diseases of the skeleton are correlated by informal participation of the many members. The significance of calcium, phosphorus, vitamin D, parathormone, citrate, renal function, and chelating agents in the pathophysiology of diseases of the skeleton are discussed, bringing up to date the metabolic interrelationship of these mineral ions with diseases of bone. The book is freely documented with tables, graphs, diagrams, and photomicrographs of bone.

This publication is an up-to-date review of the metabolic aspect of calcium metabolism as related to disease of bone. It will be best utilized by the internist, endocrinologist, and orthopedic surgeon.

—*ANTON ZIKMUND, Capt. (MC) USN*

ABDOMINAL OPERATIONS, by *Rodney Maingot,* F. R. C. S., with contributions by 24 American and British Authorities. 3d edition. 1,568 pages; 1,594 illustrations on 738 figures; 11 color plates. Appleton-Century-Crofts, Inc., New York, N. Y., 1955. Price $24.50.

In this new edition of a standard text on surgery of the abdomen the scope of the two previous editions has been extended by the addition of 11 new chapters, while 63 have been revised. Adequate and annotated descriptions are given of abdominal operations of general surgery, including seven chapters on special subjects such as diaphragmatic hernia, portal hypertension, pelvic exenteration, chest complications, and fluid balance.

Contributions in various fields by American and British authorities lend additional value to this work. Illustrations of technic are numerous and precise. Discussions of biliary and gastric surgery are excellent in their coverage, and the malformations and congenital anomalies often encountered in general surgery have been included.

An ample author index and subject index are provided. The extensive and current bibliography appears as part of the text and does not contribute to a smooth style, but presents readily available references for wider reading. The volume is organized well and written concisely. It will be a valuable aid to the experienced as well as to the less experienced surgeon.—*ROBERT L. RHEA, Jr., Col., MC, USA*

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STANDARD METHODS FOR THE EXAMINATION OF WATER, SEWAGE, AND INDUSTRIAL WASTES, prepared and published jointly by American Public Health Association, American Water Works Association, Federation of Sewage & Industrial Wastes Associations. 10th edition. 522 pages; illustrated. Publication Office, American Public Health Association, Inc., New York, N. Y., 1955. Price $7.50.

The tenth edition commemorates the fiftieth anniversary of the publication of the original volume. During the 50 years that have elapsed, this book has become the standard text for civilian and military laboratories throughout the United States. The changes and additions in the present edition are more extensive than in any previous revision, and there is considerable added information of particular interest to the military.

New material on the physical and chemical examination of water includes sections on correctness of analysis, statistics, amperometric titration and Palin methods for chlorine, and Megregian-Maier and Lamar methods for fluorine. Under physical and chemical examination of sewage, sections on precision and accuracy and a discussion of methods evaluation have been added, in addition to the three methods for dissolved oxygen. The cyanide method for physical and chemical examination of industrial wastes is practically a new one, as are spectrophotometric and photometric methods for color, colorimetric methods for heavy metals, and the amino-antipyrine methods for phenol. For bacteriologic examinations of water, the membrane filter technic has been included as a tentative procedure. There also is a new section on nuisance organisms and an additional MPN table. More explicit directions are given for collecting and examining samples for biologic examination of water, sewage, and sludge; 12 full pages of illustrations of organisms are now included.

This volume is a credit to the three associations concerned in its production. It is an indispensable reference for all who are engaged in examining water, sewage, or wastes.

—*STANLEY J. WEIDENKOPF, Lt. Col., MSC, USA*

PSYCHOLOGY, THE NURSE AND THE PATIENT, by *Doris M. Odlum*, M. A., D. P. M. 2d edition. 168 pages. Philosophical Library, New York, N. Y., 1954. Price $4.75.

The author explains in simple language the development of personality and human behavior, the relationship of mind and body, and the influence of the emotions on behavior. Psychiatric disorders and their treatment with emphasis on the role of the nurse is briefly discussed.

Although this book was written for the nurse in England, and some terms and titles used are peculiar to the British (*e. g.*, sister, tutor), the general content would be useful to any nurse, particularly to those not trained in psychology. Avoidance of technical terms, and clear explanations and format make it easy to read and understand.

—*CHARLOTTE R. RODEMAN, Maj., ANC, USA*

A TEXTBOOK OF NEUROLOGY, by *H. Houston Merritt,* M. D. 746 pages; 181 illustrations and 128 tables. Lea & Febiger, Philadelphia, Pa., 1955. Price $12.50.

This new text of neurology for medical students and practitioners places emphasis on diseases of the nervous system as a branch of internal medicine. Psychiatry and psychiatric syndromes are not considered except when mental symptoms accompany appropriate disease entities. Also omitted are the usual chapters on anatomy, physiology, and examination of the nervous system, because the author rightly concludes that these subjects require special texts for adequate coverage. In common with other volumes on clinical neurology, the various disease categories are grouped in chapters according to etiology or pathology.

Perhaps the most unique feature of this text lies in the author's effort to record factual information regarding this or that disease syndrome with little attention paid to theoretic concepts regarding etiology, pathology, or treatment. The author gives in concise nontechnical terminology the current knowledge in neurologic medicine and clearly distinguishes between time-tested facts, controversial data, and unproved assumptions. Throughout the text are frank statements such as: "The headaches which occur in patients with intracranial tumors cannot be differentiated either by their nature or their location from headaches due to other causes." Special attention is paid to the more common neurologic diseases such as migraine, epilepsy, cerebrovascular disorders, infections of the nervous system, and metabolic and endocrine disturbances, with relatively little space devoted to the classical neurologic syndromes which are rarely encountered by the internist or general practitioner.

A brief but adequate bibliography follows the discussion of each disease entity and there is a comprehensive index of more than 50 pages. This work admirably fulfills the goals set forth by its author, namely, a text of neurology for medical students and physicians. Because of its forthright style and clarity of presentation, it is also recommended to internists and psychiatrists as a superior single reference volume in clinical neurology.—*ALBERT J. GLASS, Col., MC, USA*

PATHOLOGY, by *Peter A. Herbut,* M. D. 1,227 pages; 1,378 illustrations on 651 figures, and 6 color plates. Lea & Febiger, Philadelphia, Pa., 1955. Price $16.

This textbook of pathology is written primarily for the student. It will be of great value to undergraduate students, and yet is comprehensive enough to meet the more exacting demands of postgraduates.

The book is organized along classical lines, with the first seven chapters devoted to general consideration of pathologic processes. Chapter 2 is unique among current textbooks of pathology in that it deals with the performance of an autopsy and contains handy tables of organ weights and measurements. Remaining chapters are concerned

with organs, organ systems, and the diseases of each. The chapter on the central nervous system is written by Bernard J. Alpers.

The text is up to date and there is an excellent bibliography at the end of each chapter. There are 1,378 black and white illustrations, well selected to bring out the essential pathologic features. Six color plates, which leave something to be desired as to quality, nevertheless serve to illustrate the major features with which they are concerned. The style of the text is simple, straightforward, and easily understood. The type is large and easy to read, and extensive use is made of italics to emphasize key words. The candid and somewhat pedagogic presentation of the material may not appeal to those desiring elaboration of controversial issues. With the busy student who will welcome this clear, concise, and comprehensive presentation of human pathology, however, it will strike a responsive chord.

—*FRANK M. TOWNSEND, Lt. Col., USAF (MC)*

MEDICAL STUDENTS AND MEDICAL SCIENCES, Some Problems of Education In Britain and the United States, by *D. C. Sinclair*, M. A., M. D. Oxford Medical Publications. 154 pages. Geoffrey Cumberlege, Oxford University Press, New York, N. Y., 1955. Price $5.75.

This well-written, concise monograph provides an interesting comparison of medical students and of the nonclinical aspects of medical education in the United States and Great Britain. While the comparison for the most part is based on subjective impressions rather than on an objective factual study, it nevertheless is valuable inasmuch as relatively few people have had the opportunity to observe the operation of medical schools in both countries.

Question may be raised as to the validity of the concepts gained in the author's relatively brief contact with 12 American medical schools. His prolonged contact with medical education and medical students in the British Isles lends considerably more weight to his opinions regarding medical education and medical students in that area.

This book presents much of the current concepts that are prevalent in medical educational circles today. Some new ideas are presented and older, more accepted ideas are presented in a new context. The difficulties involved in evaluating the applicants to medical school in order to select those who will make the best physicians, and the problems in evaluating a student's progress in medical school, are well pointed out. In this connection, the commendable British plan of inviting an examiner from outside of the medical school to assist in the examination of medical students is described. One of the subjects that is presented particularly well is the development of a teacher.

This book as a whole is interesting and informative. It will make worth-while and entertaining reading for any medical educator.

—*CHARLES L. LEEDHAM, Col., MC, USA*

PROTOZOOLOGY, by *Richard R. Kudo,* D. Sc. 4th edition. 968 pages; with 376 illustrations. Charles C Thomas, Publisher, Springfield, Ill., 1954. Price $10.75.

This textbook was first published in 1931 under the title *Handbook of Protozoology.* Subsequent revisions, of which this is the third, have incorporated a continuously expanding subject matter and have been entitled *Protozoology.* This edition is now more than twice the size of the first. There has been no change in aim, the book being addressed to seniors and graduates in zoology in colleges and universities.

The field of protozoology has now grown to such an extent that it is no longer possible to give full discussion of all of its phases in one volume. As in the first three editions, the emphasis is upon taxonomy. The essentials of morphology and life history are given for practically all genera. There is a listing of the better-known species accompanied by excellent illustrations. The field is so extensive, however, that the descriptions of most species have been compressed into a form so succinct as to be of limited usefulness. In spite of this fact, the taxonomic portion of the book is anything but dull and uninteresting. The typography, organization, and illustrations should make it possible for the student to determine fairly closely an unknown protozoon from any taxonomic group. However, since protozoa are of interest chiefly because of what they do, one may wish that in a text of this nature more emphasis had been placed upon these phases of their study, even at the expense of omitting taxonomic consideration of some of the groups. In its present form the book comes nearer to being a textbook of general protozoology than any previous edition.

—*CLAY G. HUFF*

POTASSIUM METABOLISM IN HEALTH AND DISEASE, by *Howard L. Holley,* M. D., and *Warner W. Carlson,* Ph. D. 131 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., 1955. Price $4.50.

This little book of 93 text pages contains a good summary of normal and abnormal potassium metabolism. As the preface states, the purpose of the monograph is to serve as a practical clinical guide to the diagnosis and treatment of alterations in the metabolism of this electrolyte. In general this purpose appears to have been achieved, although, at times, the brevity of some sections (particularly on therapy) is regrettable.

Not everyone will agree with the recommendation that calcium gluconate administered intravenously should be listed first in the emergency treatment of hyperpotassemia. Furthermore, a fuller discussion of the differential diagnosis of the clinical states associated with hypo- and hyper-potassemia would have been helpful. The appendix dealing with the potassium content of foods and municipal water supplies is valuable. Much of the material, of course, appears in larger texts on metabolism. Nevertheless, as a brief review of the essentials of an important subject, this book will prove useful.

—*S. O. WAIFE, Lt. (MC) USN*

HEMATOLOGY, by *Cyrus C. Sturgis*, M. D. 2d edition. 1,222 pages; 77 figures, 42 tables, and 9 plates in color. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $19.50.

The objective of the author, in this general reference type of textbook, is to correlate laboratory data in the field of hematology with information derived from clinical examination of the patient. Emphasis is given properly to the historical aspects of hematology, to enable the reader to understand the development of advances; furthermore, this approach is found to be innately interesting. This fact in itself makes the text well worth reading.

In this second edition, published five years after the first, material has been added on vitamin $B_{12}$, the folic acid antagonists, TEM and nitrogen mustards, the steroids, splenectomy, and the significance of drugs in the etiology of hematologic disorders. An excellent bibliography is presented at the end of each chapter. The author's comments, based on extensive experience, add spice to the reading. The book is quite comprehensive and shows a fluidity of integrated thought that is pleasing to the reader. The author points out that to keep up to date the text would have to be revised every few months; however, the established facts are presented. Each given subject succeeds the other in almost encyclopedic, informative, enjoyable form.

Thus, this book makes an excellent reference for the medical student and general practitioner, and should be made a standby by the internist.

—*ARCHIE A. HOFFMAN, Col., USAF (MC)*

THE SUBNORMAL MIND, by *Sir Cyril Burt*, D. Sc., Hon. Litt. D., Hon. LL. D. 3d edition. University of London, Heath Clark Lectures, 1933, delivered at The London School of Hygiene and Tropical Medicine. 391 pages. Oxford University Press, New York, N. Y., 1955. Price $5.

This book is directed to educators, physicians, clinical psychologists, and laymen who are concerned with the psychologic problems of subnormal school children.

The author's lucid style of writing lends itself well to the simple organization of the book. The first chapter presents his theory of personality. Subsequent chapters apply this theoretic system to the etiology, diagnosis, and treatment of mental deficiency, delinquency, intellectual dullness, and neurosis. A closing chapter is devoted to a discussion of the incidence of these problems in England, as well as a discussion of interview methods and psychologic tests.

The theory of personality is essentially a biologic theory, resting on a proposed inherited set of instincts, and reflecting the English faculty psychology of the 1920's. Although the numerous case studies make use of the author's sensitive clinical intuition and perceptiveness, the sections on treatment are restricted by the theoretic emphasis on inheritance of instincts. If, for example, "much juvenile delinquency . . . is simply an automatic outburst of some inherited mode of response . . .", then treatment of delinquency necessarily is limited.

Although the 1935 edition of *The Subnormal Mind* was an important contribution, the present edition fails to integrate subsequent advances in research methodology, projective testing, personality theory, and abnormal and child psychology. The Rorschach, for example, is described as "but little known" in England, and no mention is made of the Thematic Apperception Test. The research studies could profit from modern advances in sampling technics and recent statistical tools. Finally, there is a conspicuous absence of contemporary approaches to personality theory and psychotherapy, as well as an absence of vast bodies of experimental data and discussions of mental deficiency, delinquency, and neurosis.

It is the reviewer's opinion that the present contribution of this book is limited. As a guide to the treatment of subnormal school children it is overshadowed by more modern texts.

—*ALVIN R. MAHRER, 2d Lt., MSC, USA*

THE YEAR BOOK OF NEUROLOGY, PSYCHIATRY AND NEUROSURGERY (1954-1955 Year Book Series). Neurology, edited by *Roland P. Mackay*, M. D., Psychiatry, edited by *S. Bernard Wortis*, M. D., Neurosurgery, edited by *Percival Bailey*, M. D., and *Oscar Sugar*, M. D. 619 pages; 97 figures. The Year Book Publishers, Inc., Chicago, Ill., 1955. Price $7.

This Year Book, as in the past, is an important contribution in presenting various methods of treatment, research, and general trends in an objective manner. Particularly in psychiatry, which comprises a discipline that is extremely un-uniform, it is imperative that comparisons be made of the multiplicity of therapeutic methods so that an exclusive philosophy of treatment or rigid creed of psychodynamics will not dominate the field to the exclusion of other methods which may very well be just as effective.

In the section on neurology, advances in infectious diseases are stressed in terms of the new antibiotics and the more frequent late complications of such diseases. Basic work in terms of anatomy and physiology focuses on the universal use and results of localization and physiologic neuronography studies. There is an excellent review of the neurologic aspects of basic metabolic dysfunction as well as the relationship of such factors to the problems of myasthenia and myopathy.

The neurosurgical section stresses some of the results and moral aspects of psychosurgical problems, as well as emphasizes the diagnostic and newer ancillary anesthetic, hypotensive, and hybernation technics. The collective material encompasses all therapeutic aspects in the major fields of operative neurosurgery.

The section on psychiatry indicates that the literature in psychiatry shows five positive trends: (1) A greater interest in the sociologic and environmental factors related to mental health and illness; (2) a resurgence of interest in physiologic research; (3) an increase in psy-

chosomatic studies; (4) increasing interest in treatment procedures and efforts to evaluate their relative therapeutic effectiveness; and (5) growing interest in child psychiatry, especially of childhood schizophrenia. There is a negative trend because of the dearth of publications in newer basic dynamic conceptual material, clinical psychiatry, industrial psychiatry, and preventive psychiatry.

The subsection on therapy includes a considerable number of articles which report the original results obtained in the use of the new drugs in the treatment of psychiatric illnesses. The editor concludes that the literature points up an urgent need for an interdisciplinary correlation of data, a better understanding of biostatistical methods, a sober evalution of the effectiveness of different treatment procedures, more specific etiologic data, and dynamic *quantitative* measurement methods.

—*EMMETT B. LITTERAL, Col., MC, USA*

THE CIBA COLLECTION OF MEDICAL ILLUSTRATIONS, Volume 2: Reproductive System, prepared by *Frank H. Netter,* M. D.; edited by *Ernst Oppenheimer,* M. D., with a foreword by *John Rock,* M. D. 286 pages; illustrated. Published by Ciba Pharmaceutical Products, Inc., Summit, N. J., 1954. Price $13.

This volume is the second in a series which will portray each of the major anatomic and physiologic systems of the human body.

Doctor Netter, whose outstanding work as a medical illustrator is known to all physicians, has succeeded in compiling a distinctly valuable book on the male and female reproductive systems. Under the editorship of Doctor Ernst Oppenheimer and with texts contributed by 11 of the leaders in the field of urology, obstetrics, and gynecology, this book fills a need in the teaching of many of the involved processes of reproduction.

Beginning with the first section, which illustrates and describes the development of the genital tracts, the book contains four sections on the male tract and six on the female. One section each is devoted to pregnancy, the mammary gland, and the intersexes. These 14 sections completely cover the field.

The reviewer was impressed by the ease with which the excellent colored illustrations could be studied while the text was being read, both illustrations and text being presented on the same page. This effective method results in the reader's retention of the picture together with the facts. The index is well arranged and subject matter is easily located. The 104 full-color, carefully labeled illustrations are not themselves indexed, but can be located readily by subject.

Although each of the sections is significantly valuable, the section on pregnancy was read by the reviewer with the greatest interest. Judging by the high standards reached by this volume, the medical profession can expect the succeeding volumes to contribute materially to the field of medical teaching.—*MORRIS M. RUBIN, Capt. (MC) USN*

THE COLON: ITS NORMAL AND ABNORMAL PHYSIOLOGY AND THERAPEUTICS, edited by *Roy Waldo Miner.* 248 pages; illustrated. The New York Academy of Sciences, New York, N. Y., 1954. Price $4.50.

This monograph assembles under one cover the present opinions of various experts on the colon, as reported at a conference held by the Section of Biology of the New York Academy of Sciences on 8 and 9 May 1953. The main theme of the volume is the intercommunication among investigators in many different fields, and in this light it is highly successful.

Part 1 is confined to the physiology and pharmacology of the colon in its more basic aspects. One of the most interesting reports was that by Dr. H. A. Gordon of the Notre Dame group experimenting in "germ-free" animals. They found that in these animals, born and raised without bacteria, the cecum is 10 to 20 times as large as in normal animals. Part 2 covers the causes of colonic disorders and is primarily concerned with the psychogenic background, from childhood experiences to life stress situations. The differentiation in end result between the "irritable bowel" syndrome and true ulcerative colitis is well made in the panel discussion. In part 3, abnormal colonic pharmacology is very well discussed and covers laxatives, antispasmodics, and steroids. Part 4 is concerned with the therapeutic management of colonic disorders. It points up the practical clinical use of the preceding knowledge.

This is a well-organized and illustrated book and presents an exceptional bibliography at the end of each report. It is a must for any doctor who attempts to treat colonic diseases.

—*LESTER J. POPE, Comdr. (MC) USN*

THE YEAR BOOK OF ORTHOPEDICS AND TRAUMATIC SURGERY (1954-1955 Year Book Series), edited by *Edward L. Compere,* M. D., F. A. C. S., F. I. C. S. 384 pages; 193 illustrations. The Year Book Publishers, Inc., Chicago, Ill., 1955. Price $6.

This book brings the review of orthopedic and traumatic surgery up to May 1955. As usual the text reports American and foreign literature on the subject in a concise and adequate manner. The short abstracts include the basic reference at the bottom of each page, so that bibliography searching is not necessary. The abstracts obviously are made by a varied group of assistants, and the author adds editorial notes in many instances. These, although not adding information, express his opinion about the subject reviewed. Illustrations provided when necessary to augment the text are well reproduced.

This series continues to serve a useful purpose in abstract literature and saves considerable reading time for interested physicians. Those who have made use of previous issues, as well as those newly interested in the subject, will benefit by reviewing this text.

—*STERLING J. RITCHEY, Col., MC, USA*

STUDIES ON FERTILITY, Including papers read at the Conference of the Society for the Study of Fertility, London, 1954, Being Volume VI of the Proceedings of the Society. Edited by *R. G. Harrison*, M. A., D. M. 151 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1954. Price $4.25.

This little book contains 16 articles (chapters), of which only two are of any real value to the clinician. One is "The Management of Pregnancy in the Previously Infertile Woman," and the other is "The Value of Timing of Ovulation in the Treatment of Sterility." The latter paper is available from other sources.

Much of the space in the book, which really should be a journal, is devoted to fundamental research and is at the moment of no interest to the clinician. The book is well bound, clearly printed on good paper, and should be in reference libraries.—*JOHN W. SIMPSON, Col., MC, USA*

THE CHEMISTRY OF MICRO-ORGANISMS, by *Arthur Bracken*, Ph.D., F.R.I.C. 343 pages; illustrated. Pitman Publishing Corp., New York, N. Y., 1955. Price $6.

This is an exceptionally good book in a specialized field. Designed as a series of lectures for a polytechnic school in London, it is highly technical and will be little appreciated by anyone not thoroughly trained in organic chemistry.

The author treats the subject of the organisms themselves in a non-technical fashion that is somewhat misleading; for example, rickettsiae are referred to as "small parasitic bacteria." This approach stems from the fact that these lectures are directed at an audience with highly diversified training. On the other hand, the author is careful to point out that certain opinions that he expresses are at best on shaky ground in view of current investigations which will perhaps necessitate a revision in our way of thinking on such subjects. A typical example of this is the statement that ". . . . bacteria lead a completely sex-free life. . . ."

The section on antibiotics is well written and the clinical limitations of certain of the antibiotics well covered; however, considerable space is given over to descriptions of the synthesis and physical properties of certain antibiotics which are no longer in practical use.

The style and format are good; the text is readable (provided one has a working knowledge of structural organic chemistry); and the book is well documented with up-to-date references from both American and foreign periodicals. The index provides a ready reference to any specific compound or topic.

This book should prove of value to those interested in the field of microbial physiology or antibiotic development, but is not recommended for those who desire a more fundamental approach to the biochemistry of micro-organisms.—*DAVID F. HERSEY, Capt., USAF (MSC)*

CONNECTIONS OF THE FRONTAL CORTEX OF THE MONKEY, by *Wendell J. S. Krieg.* 299 pages. Charles C Thomas, Publisher, Springfield, Ill., 1954. Price $10.50.

This book presents a detailed analysis of data relative to studies on the connections of the frontal cortex of the monkey. The author has made and recorded the observations on 70 spaced cortical lesions, and by the Marchi impregnation method has traced the myelinated corticifugal fibers to their termination and position within the white matter.

The book is not a text, but provides an integrated account of the frontal cortex as a further aid to a better understanding of the functional role of this part of the brain. Certainly the best use of this book will be made by students of cyto-architectonics and "physiologic neuronography." In its current form it will have little appeal to the average clinician and is primarily intended for those specialists engaged in investigations of cortical neuroanatomy and neurophysiology.

—*CHARLES N. LUTTRELL, Jr., Lt. (MC) USNR*

REACTIONS WITH DRUG THERAPY, by *Harry L. Alexander,* M. D. 301 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1955.

This book meets the requirements for a comprehensive reference book for the internist and allergist, and also for any physician or surgeon who uses many antibiotics and other medicines in his professional practice. As the author states, hundreds of thousands of substances have been employed as drugs, yet only a thousand or less are in common use. Probably every practicing physician and surgeon has some time or other seen a "reaction" to some drug they have prescribed for their patients. The discussion of reactions to drugs is limited to those of "hypersensitivity," and does not include those due to poisoning from over-dosage or to expected pharmacologic reactions.

The format of this book is excellent in that the author presents the mechanisms of drug reactions generally, then the various forms of dermatologic manifestations, followed by the more serious systemic patterns. The drugs are classified as anti-infectious medications; antiarthritic medications; drugs used in cardiovascular disorders; sedative drugs; antithyroid drugs; antihistamines; organ extracts; vitamins; serums and vaccines; plant products; local anesthetics; and finally a chapter on miscellaneous drugs. The author has compiled his data from hundreds of references, which are listed at the end of each chapter, as well as from his own many years of experience.

The book includes several tables showing drugs that induce the many forms of hypersensitivity reactions. This includes such medicines as sulfonamides, which produce at least 15 out of 16 types of reactions, and is closely followed by the mercurials, penicillin, iodides, arsenicals, and gold salts. The author's description on systemic reactions is very clear and includes appropriate forms of treatment. The chapter on serums and vaccines is especially good and is im-

portant for the modern day physician to read for general knowledge of the "reactions" with drugs, even though serums and vaccines are not in use as widely as before the days of our numerous antibiotics. A reviewer of this book has difficulty in finding any errors but it may be worthwhile to note that under the listing of drugs used in cardiovascular disorders no mention is made of the dermatologic hypersensitivity manifestations occasionally seen with the use of dicumarol. This is not too common but could be included for the sake of completeness.

I believe this is an excellent book for which there has been a great demand by general practitioners as well as specialists of all branches.

*—URHO R. MERIKANGAS, Col., MC, USA*

FREEDOM FROM FEAR, by *Lester L. Coleman*, M. D. 285 pages. Hawthorne Books, Inc., New York, N. Y., 1954. Price $3.95.

This book was written for popular consumption by a well-known otolaryngologist who has been interested for many years in the psychosomatic aspects of his practice. It is concerned with the increasingly important problem of the instigation and perpetuation of emotional and physical illness by fear and anxiety. Dr. Coleman says many things that should be said often, and he says them interestingly and with a wealth of appropriate illustration. In handling his theme he shows more sophistication and balance than are seen in many similar popularizations.

All of the chapters except one seem addressed primarily to the lay public (although many doctors could profit from a reading of the enitre volume). This one chapter, which is the finest and most useful chapter in the book, is concerned with the psychological preparation of the child for surgery. It should be required reading for all surgeons and nurses in hospitals. In other chapters the book does not entirely escape the pitfalls of oversimplification, scientific half-truths, and the overoptimistic assumptions associated with most attempts at popularizations of psychological subjects. There also are occasional lapses into facile writing and vague phrasing. Furthermore, the jacket blurb is misleading in its statement that the book is "a practical guide to self-understanding and the conquest of fear." This statement seems more a reflection of the publisher's ideas of what is necessary to sell a book of this kind than of Doctor Coleman's own intent.

With all its limitations, inherent and otherwise, this is a good book of its type. I hope that it has a wide circulation, not because it is of any immediate "practical" value to the person suffering the effects of fear and anxiety who happens to read it, but because such books may add a tiny bit to the sum total of our culture's consciousness of the invidious influence of these affects on human efficiency and happiness.—*CHARLES S. MULLIN, Comdr. (MC) USN*

# New Books Received

Books received by the *U. S. Armed Forces Medical Journal* are acknowledged in this department. Those of greatest interest will be selected for review in a later issue.

PRACTICAL ORAL SURGERY, by *Henry B. Clark, Jr.*, M. D., D. D. S. 392 pages; 223 illustrations. Lea & Febiger, Philadelphia, Pa., 1955. Price $8.50.

DIFFERENTIAL DIAGNOSIS, The Interpretation of Clinical Evidence, by *A. McGehee Harvey*, M. D., and *James Bordley, III*, M. D. 665 pages. W. B. Saunders Co., Philadelphia, Pa., 1955.

THE PRACTICE OF DYNAMIC PSYCHIATRY, by *Jules H. Masserman*, M. D. 790 pages. W. B. Saunders Co., Philadelphia, Pa., 1955.

KINESIOLOGY, by *Katharine F. Wells*, Ph. D. 2d edition. 516 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., 1955.

DOCTOR AND PATIENT, by *Desmond O'Neill*, M. D., M. R. C. P. (Lond.), D. P. M. (Eng.). 197 pages. J. B. Lippincott Co., Philadelphia, Pa., 1955. Price $5.

CARDIOLOGY NOTEBOOK For Preliminary Instruction in Medical Curricula. Columbia University College of Physicians and Surgeons. 97 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., 1955. Price $2.50.

PROCEEDINGS OF THE THIRD MEDICAL CONFERENCE OF MUSCULAR DYSTROPHY ASSOCIATIONS OF AMERICA, INC., October 8 and 9, 1954 in New York, N. Y. 324 pages; illustrated. Muscular Dystrophy Association of America, Inc., New York, N. Y., 1955.

DISEASES OF THE EAR, NOSE AND THROAT, by *William Wallace Morrison*, M. D. 2d edition. 756 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., 1955.

OF PUBLISHING SCIENTIFIC PAPERS, by *George E. Burch*, M. D., F. A. C. P 40 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., 1954. Price $2.75.

HEARING THERAPY FOR CHILDREN, by *Alice Streng*, M. A.; *Waring J. Fitch*, M. A.; *LeRoy D. Hedgecock*, Ph. D.; *James W. Phillips*, M. D.; and *James A. Carrell*, Ph. D. 371 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., 1955. Price $6.75.

BRITISH MEDICAL BULLETIN, Blood Coagulation and Thrombosis, Volume XI, Number 1. 82 pages; illustrated. Published by Medical Department, The British Council, London, April 1955. Distributed by Oxford University Press, New York, N. Y. Price $2.75.

BRITISH MEDICAL BULLETIN, Hormones in Reproduction, Volume XI, Number 2. 170 pages; illustrated. Published by Medical Department, The British Council, London, May 1955. Distributed by Oxford University Press, New York, N. Y. Price $2.75.

PSYCHIATRY AND THE LAW. The Proceedings of the Forty-Third Annual Meeting of the American Psychopathological Association, held in New York City, June 1953. Edited by *Paul H. Hock*, M. D., and *Joseph Zubin*, Ph. D. 232 pages; illustrated. Grune & Stratton, Inc., New York, N. Y., 1955. Price $5.50.

ATLAS OF ROENTGEN ANATOMY OF THE SKULL, by *Lewis E. Etter*, M. D., F. A. C. R., with a section on the Radiographic Anatomy of the Temporal Bone, by *J. Brown Farrior*, M. D., F. A. C. S., and a section on the Roentgen Anatomy of the Skull in the Newborn Infant, by *Samuel G. Henderson*, M. D., F. A. C. R., and *Louise S. Sherman*, M. D. 216 pages; 239 plates. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $14.75.

RADIOGRAPHIC ATLAS OF SKELETAL DEVELOPMENT OF THE KNEE, A Standard of Reference, by *S. Idell Pyle*, Ph. D., and *Normand L. Hoerr*, Ph. D., M. D. 82 pages; 29 plates. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $4.25.

BLOOD SUPPLY AND ANATOMY OF THE UPPER ABDOMINAL ORGANS, With a Descriptive Atlas, by *Nicholas A. Michels*, M. A., D. Sc. (Louvain). 581 pages; 172 illustrations, including 166 in color. J. B. Lippincott Co., Philadelphia, Pa., 1955. Price $24.

NEW AND NONOFFICIAL REMEDIES, 1955. Containing Descriptions of the Articles which stand Accepted by the Council on Pharmacy and Chemistry of the American Medical Association on January 1, 1955. Issued under the Direction and Supervision of The Council on Pharmacy and Chemistry, American Medical Association. 653 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., 1955. Price $3.35.

CIBA FOUNDATION COLLOQUIA ON AGEING. Volume I, General Aspects, by editors for the Ciba Foundation, *G. E. W. Wolstenholme*, O. B. E., M. A., M. B., B. Ch., and *Margaret P. Cameron*, M. A., A. B. L. S. 268 pages; 38 illustrations. Little, Brown & Co., Boston, Mass., 1955. Price $6.75.

THE VISUAL FIELDS, A Study of the Applications of Quantitative Perimetry to the Anatomy and Pathology of the Visual Pathways, by *Brodie Hughes*, M. B., B. S. (Lond.), CH. M. (Birm.), F. R. C. S. (Eng.). 174 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1954. Price $7.25.

TEXTBOOK OF HEALTHFUL LIVING, by *Harold S. Diehl*, M. A., M. D., Sc. D. 5th edition. 802 pages; illustrated. McGraw-Hill Book Co., Inc., New York, N. Y., 1955. Price $6.

COUGH SYNCOPE, by *Vincent J. Derbes*, M. D., F. A. C. P., and *Andrew Kerr, Jr.*, M. D. American Lecture Series, Publication No. 231. A Monograph in The Bannerstone Division of American Lectures in Internal Medicine. Edited by *Roscoe L. Pullen*, A. B., M. D., F. A. C. P. 182 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $4.75.

INTESTINAL OBSTRUCTIONS, Physiological, Pathological and Clinical Considerations With Emphasis on Therapy, Including Description of Operative Procedures, by *Owen H. Wangensteen*, B. A., M. D., Ph. D. 3d edition. 838 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $15.50.

THE DENTAL ASSISTANT, edited by *John C. Brauer*, D. D. S., M. Sc. 398 pages; illustrated. The Blakiston Div., McGraw-Hill Book Co., Inc., New York, N. Y., 1955. Price $7.

PROBLEMS OF CONSCIOUSNESS, Transactions of the Fifth Conference, March 22, 23, and 24, 1954, Princeton, N. J. Edited by *Harold A. Abramson,* M. D. 180 pages; illustrated. Sponsored by the Josiah Macy, Jr. Foundation, New York, N. Y., 1955. Price $3.50.

NEUROCHEMISTRY, The Chemical Dynamics of Brain and Nerve, edited by *K. A. C. Elliott, Irvine H. Page,* and *J. H. Quastel.* 900 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $19.50.

A DICTIONARY OF TERMS IN PHARMACOGNOSY, AND OTHER DIVISIONS OF ECONOMIC BOTANY, by *George Macdonald Hocking,* Ph. D. 284 pages. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $9.75.

SELECTION OF ANESTHESIA, The Physiological and Pharmacological Basis, by *John Adriani,* M. D. 327 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $6.50.

SURGICAL PHYSIOLOGY OF THE ADRENAL CORTEX, by *James D. Hardy,* M. S. (Chem.), M. D., F. A. C. S. 191 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $5.75.

VIRUS AND RICKETTSIAL DISEASES, by *S. P. Bedson,* M. D., D. Sc., F. R. C. P., F. R. S., *A. W. Downie,* D. Sc., M. D., *F. O. MacCallum,* B. Sc., M. D., and *C. H. Stuart-Harris,* M. D., F. R. C. P. 2d edition. 406 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1955. Price $6.75.

AN OUTLINE OF PRESENT DAY THORACIC SURGERY, by *Robert I. Carlson,* M. D. 158 pages. Educational Publishers, Inc., St. Louis, Mo., 1954. Price $4.25.

THE PATHOGENESIS OF POLIOMYELITIS, by *Harold K. Faber,* M. D. 157 pages; illustrated. Charles C Thomas, Springfield, Ill., 1955. Price $5.

CLINICAL TOXICOLOGY, by *Clinton H. Thienes,* M. D., Ph. D., and *Thomas J. Haley,* Ph. D. 3d edition. 457 pages; illustrated. Lea & Febiger, Philadelphia, Pa., 1955. Price $6.50.

ADAPTIVE HUMAN FERTILITY, by *Paul S. Henshaw,* Ph. D. 322 pages; illustrated. The Blakiston Div., McGraw-Hill Book Co., New York, N. Y., 1955. Price $5.50.

LABORATORY IDENTIFICATION OF PATHOGENIC FUNGI SIMPLIFIED, by *Elizabeth L. Hazen,* Ph. D. and *Frank Curtis Reed.* American Lecture Series, Publication No. 253, A Monograph in American Lectures in Tests and Techniques. Edited by *Gilbert Dalldorf,* M. D. 108 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $5.50.

SURGERY OF THE SMALL AND LARGE INTESTINE, A Handbook of Operative Surgery, by *Charles W. Mayo,* M. D., Section of Surgery, Mayo Clinic, Rochester, Minn.; Professor of Surgery, Mayo Foundation, Graduate School, University of Minnesota. 340 pages; illustrated by *Russell Drake.* The Year Book Publishers, Inc., Chicago, Ill., 1955. Price $9.

THE ABNORMAL PNEUMOENCEPHALOGRAM, by *Leo M. Davidoff,* M. D., Professor and Chairman, Department of Surgery of the Albert Einstein College of Medicine, and Director of Surgery, Bronx Municipal Hospital Center. Chief of Neurosurgery, Mount Sinai Hospital, New York, N. Y., and *Bernard S. Epstein,* M. D., Chief, Department of Radiology, The Long Branch Jewish Hospital, New Hyde Park, N. Y. 2d edition, thoroughly revised. 518 pages; with 696 illustrations on 291 figures. Lea & Febiger, Philadelphia, Pa., 1955. Price $15.

CLINICAL DIAGNOSIS, by *Elmer G. Wakefield,* B. S. A., B. Sc., M. D., F. A. C. P., Diplomate of the American Board of Internal Medicine; Consulting Physician, Section of Medicine, Mayo Clinic, and Associate Professor of Medicine, Mayo Foundation for Medical Education and Research, Graduate School, University of Minnesota, Rochester, Minn. 1,611 pages; 135 illustrations. Appleton-Century-Crofts, Inc., New York, N. Y., 1955. Price $22.50.

SADDLE BLOCK ANESTHESIA, by *Ray T. Parmley,* M. D. American Lecture Series, Publication Number 258, A Monograph in American Lectures in Anesthesiology, edited by *John Adriani,* M. D. 59 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1955. Price $2.50.

TRANSPLANTATION OF TISSUES, Cartilage, Bone, Fascia, Tendon, and Muscle, by *Lyndon A. Peer,* M. D. Volume I. 421 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., 1955. Price $13.50.

TALKING WITH PATIENTS, by *Brian Bird,* M. D. 154 pages. J. B. Lippincott Co., Philadelphia, Pa., 1955. Price $3.

INDUSTRY AND TROPICAL HEALTH II, Proceedings of the Second Conference, Industrial Council for Tropical Health. Sponsored by The Harvard School of Public Health, April 20-22, 1954, in New York and Boston. 266 pages; illustrated. Published for The Industrial Council for Tropical Health by The Harvard School of Public Health, Boston, Mass., 1955. Price $10 (Professional Rate $5).

YOUTH'S OUTLOOK ON THE FUTURE, A Cross-National Study, by *James M. Gillespie,* Colby College, and *Gordon W. Allport,* Harvard University. Doubleday Papers in Psychology, DPP 15. 61 pages. Doubleday & Co., Inc., Garden City, N. Y., 1955. Price $0.85.

INDICES OF HEAT STRESS, A Statistical Comparison of Effective Temperature and an Index Based on Sweat Loss, by *F. E. Smith.* Medical Research Council Memorandum No. 29. 52 pages; illustrated. Her Majesty's Stationery Office, London, E. C. 1, 1955. Price $0.50 (two shillings net).

FRACTURES AND JOINT INJURIES, Volume II, by Sir *Reginald Watson-Jones,* F. R. C. S., F. R. A. C. S. (Hon), F. A. C. S. (Hon), F. R. C. S. E. (Hon), M. Ch. Orth., B. Sc., M. B., Ch. B., M. R. C. S., L. R. C. P. 4th edition. 1,073 pages; illustrated. Williams & Wilkins Co., Baltimore, Md., 1955. Price $22.

SYSTEMIC ASSOCIATIONS AND TREATMENT OF SKIN DISEASES, by *Kurt Wiener,* M. D. 556 pages; 90 text illustrations. C. V. Mosby Co., St. Louis, Mo., 1955. Price $17.

PELVO-SPONDYLITIS OSSIFICANS, Rheumatoid or Ankylosing Spondylitis, by *Ragnar Romanus,* M. D., and *Sven Yden,* M. D. 161 pages; illustrated. Year Book Publishers, Chicago, Ill., 1955. Price $8.50.

KRONFELD'S HISTOPATHOLOGY OF THE TEETH and Their Surrounding Structures. Revised and edited by *Paul E. Boyle,* D. M. D. 4th edition. 535 pages; 497 illustrations and 7 color plates. Lea & Febiger, Philadelphia, Pa., 1955. Price $10.

THE PREVENTION OF DISEASE IN EVERYDAY PRACTICE, by *Isadore Givner,* B. S., M. D., F. A. C. S., and *Maurice Bruger,* M. Sc., M. D., C. M., F. A. C. P. 964 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., 1955. Price $20.

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